COAL AGE

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Standardizing Mining Equipment

THE standardizing of mining machinery and equipment, a plan that has been recently considered by the American Mining Congress, should prove, provided the details can be satisfactorily arranged, one of the greatest boons to both operators and manufacturers that has yet graced the history of the industry. It is difficult to say, other than to hazard a guess, how much weight any adopted and approved standards of equipment would have, but there is little doubt that any regulations accepted could meet with anything other than instant and hearty approval.

That this idea is a step in the right direction, no one can dispute. While no attempt would be made to even suggest that mines already in operation should change their equipment *en masse* to that conforming with the new standards, yet each succeeding year would see worn-out parts supplanted by regulation types. However it is more with respect to mines of the future that the approved standards would apply.

Coal mining in all its various phases of operation would be simpler and more intensified today, if certain standards of equipment had been established twenty years ago. Take for instance the subject of track gages. At present a variance is found that ranges from 18 to 56½ in., with a large number of ½in. divisions. This variation arose probably more than anything else because of the fact that individual engineers had individual opinions as to what constituted a suitable gage. It was doubtless aggravated also by the fact that many exising mines were opened at a time when mule haulage only was in vogue.

A standard gage as suggested by one of the committees of the American Mining Congress is 42 in. This figure was arrived at after it had been proved that 75 per cent. of all new operations were being equipped with a gage of this width. As the mines of the future will undoubtedly be larger, from the standpoint of production, than anything at present existing, this figure should prove to be a good one. A semi-standard of 36 in. was also suggested. This was to be applied in connection with longwall mining where it is desired to keep the pack-walls close together and to employ a narrow car.

We may take as another example, the design of a mine car that can be used in this field. There has usually, heretofore, existed a concrete ratio between the track gage, length of wheelbase and inside length of car. The width and height of the car, of course, are governed by the conditions encountered and the thickness of the bed in which the car is employed. A standard such as the one suggested should adequately handle any of the operations of the future, no matter how large from the standpoint of production. The ratio suggested as a standard may be stated as being one wherein the inside length of a car is three times the length of the wheelbase, and the wheelbase is 7/9 of the track gage.

Short-radius bumpers are likewise advantageous on mine cars, as this design goes hand in hand with a one-link coupling. Not only are short-radius curves on the track easier to take but much of the jerking and jarring resultant upon taking up of the slack in the trip in starting is thus eliminated.

The adoption of standard dimensions, whether in mine equipment or anything else, is of course at first fraught with many difficulties. Probably no standard was ever adopted that did not receive opposition, usually from several sources. One has, however, only to consider the difficulties under which modern engineering would labor were it not for standard threads, pipe, fittings, and the like, to appreciate what possible benefits may accrue from the adoption of standard mining equipment.

Like present-day railway apparatus, the adoption of uniform sizes of mine equipment will not be attained in a day, a week, or a year. It must in most cases wait upon the obsolescence of the equipment and material now in use. Its ultimate adoption will, however, mark a long stride in advance for the mining industry.

Some Factors That Affect the Washability of a Coal*

Improvement of the quality of coal through washing is a subject of much interest at present. Experimental work thus far conducted would indicate that heavy impurities, or those with a specific gravity exceeding 1.6 may be successfully removed from coal. Those with a specific gravity of less than 1.3 are extremely difficult to remove and those impurities with specific gravities lying between these limits may or may not be removable with facility.

BY THOMAS FRAZER† AND H. T. YANCEY‡
Urbana, Ill.

BECAUSE of the present interest in the subject of sulphur in coal and its removal, such information as is available in coal-washing literature on the various factors that determine the adaptability of a coal for washing has been collected and is presented here, together with some observations based on results of experimental work carried out in the coal-washing laboratory of the mining department of the University of Illinois, and investigative work at Illinois washeries in connection with the work on reduction of the sulphur content of coal, being carried on at the Urbana Station of the U. S. Bureau of Mines. This investigative work consisted of the examination and testing of commercial washeries, the chemical and physical examination of raw and washed coals, and coal-washing tests with jigs and washing tables of one-fourth commercial size. The tables used are shown in Fig. 1. The writers have not had a wide experience in commercial coal washing.

The process of washing a coal consists in the mechanical removal of impure pieces heavier than the pieces of clean coal, and higher in ash and sulphur content. The characteristics of a coal, therefore, that determine the possibility of improving it by washing are the characteristics of these impurities—that is, their physical and chemical form and their specific gravity and behavior in water.

PHYSICAL FORM OF IMPURITIES

The two removable impurities commonly present in coal which are of chief interest in connection with coal washing are shale or slate, and pyrite. Calcite and gypsum are ordinarily present only in insignificant amounts, although in some cases their removal may result in an appreciable improvement.

The reduction in ash content of a coal by the removal of shale or slate is commonly less difficult than the removal of sulphur. In order of their removability, the various forms in which the ash in a coal occurs may be classed as follows:

1. Clean solid pieces of shale or slate ¼ in. or more thick with a natural plane of breakage between shale and coal. This class of impurity includes the definite shale or slate bands occurring in the coal bed, and extraneous matter from the roof and floor introduced during mining.

2. Bands of clean shale "frozen" to the adjacent coal, and thin bands of shale and coal interbedded.

3. Clay, shale dust and friable shales that disintegrate in water.

4. Fine ash particles distributed through the coal, forming carbonaceous shale, bone and high-ash coal. If ash occurs in this form to an excessive degree, it makes impossible the production of a low ash coal by washing. Two coals of this nature have been examined. In one case, a washed coal of good appearance, free from visible extraneous impurities, analyzed 21 per cent ash, and in the other case coal lighter than 1.4 specific gravity analyzed 13 per cent ash.

Although it is possible to remove some of the ash occurring in any of these forms, a coal to be classed as easily and economically washable should contain most of its excess undesirable ash in the form of separable clean particles of shale or slate of high specific gravity. A painstaking visual examination will reveal much concerning the removability of the ash impurities in a coal. This is true in a lesser degree of the sulphur impurities.

EASILY REMOVABLE FORMS OF SULPHUR

The easily removable form of sulphur is the lens, ball or band of clean pyrite ⅛ in. or more in thickness. The solid fine-grained band breaks with little sliming and, due to its high specific gravity, it is almost completely removable. A somewhat different form, not uncommon in Illinois, is of a porous cellular structure and usually of a bright yellow color. It is much lighter than the solid pyrite and breaks down easily into thin plates and slime, difficult to remove. Specific-gravity determinations on pieces of these two kinds of pyrite from a Franklin County, Illinois, coal showed 4 for the solid and 2.9 for the porous pieces.

The most troublesome visible forms of sulphur for the washery man are the thin bands, plates and veinlets of pyrite distributed through some coals; this form is very common in the southern Illinois field. Knife-edge plates sometimes fill all the joint fissures in large lumps of coal, the individual plates being in many cases so thin as to resemble spots of gold paint. When the coal is crushed for washing, a large part of this sulphur adheres to the coal and a considerable part of that which breaks free is slimed or broken into extremely thin plates, which have a tendency to float when the coal is washed. The thin bands of pyrite sometimes occur interbedded with thin bands of coal, forming pieces part coal and part pyrite that may be removed in their entirety by jigging at a comparatively large size, whereas if the coal were crushed fine in an effort to free the pyrite, washing would not be successful. A small percentage of this kind of pyrite gives the appearance of a much larger quantity.

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†Assistant mining engineer, U. S. Bureau of Mines.
‡Assistant chemist, U. S. Bureau of Mines.

TABLE I. HAND-PICKED SAMPLES OF A WILLIAMSON COUNTY ILLINOIS, COAL

Sample No.	Ash, per Cent.	Pyritic Sulphur, per Cent.	Organic Sulphur, per Cent.
1	3.58	1.27	0.79
2	4.82	1.06	0.79
3*	4.27	0.84	0.79

*Float on solution of 1.3 sp.gr.

In all the coals used in the investigations, tests have indicated, also, the presence of pyritic sulphur in a finely divided state. Samples of coal, finer than ⅛ in., carefully hand-picked to reject all pieces showing a trace of impurity, contained pyritic sulphur. Analyses of three such samples of a Williamson County, Illinois, coal are given in Table I. It is believed that these samples were crushed to such size as to expose all the natural cleavage faces on which the visible forms of pyrite are commonly found.

The physical form of impurities present not only affects the amenability of a coal to improvement by washing, but determines also the size to which it must be crushed. Now that tables are being commonly used for washing coal, it might be expected that since this material can be crushed finer for washing, a cleaner product might be produced by that method. Actual tests with tables have indicated, however, that this is problematical. It is not safe to assume that any coal that can be successfully washed on coarse jigs can be cleaned more completely by washing at a finer size on tables. The effect of finer crushing upon the completeness with which impurities may be separated from coal depends upon two opposing tendencies. First, the more finely a raw coal is crushed, the more completely will the particles of impurities be detached from those of clean coal. Second, the finer a coal is crushed the more difficult it becomes to separate the pieces of clean refuse from the pieces of clean coal. The proper size for washing the raw coal therefore depends on the proper balance of these two tendencies. Thomas J. Drakely,[1] of Wigan, England, in a paper on coal washing, expresses the opinion that in British practice as a general rule the size at which the most complete separation is secured is 1¼ in. The common American practice would indicate that here the size is considerably smaller. It is difficult to say what is the minimum size of coal that can be improved by washing. The finest coal that has been successfully treated in washing tests at Urbana was an overflow sludge from a washery settling tank. The size is indicated in Table II, showing the results

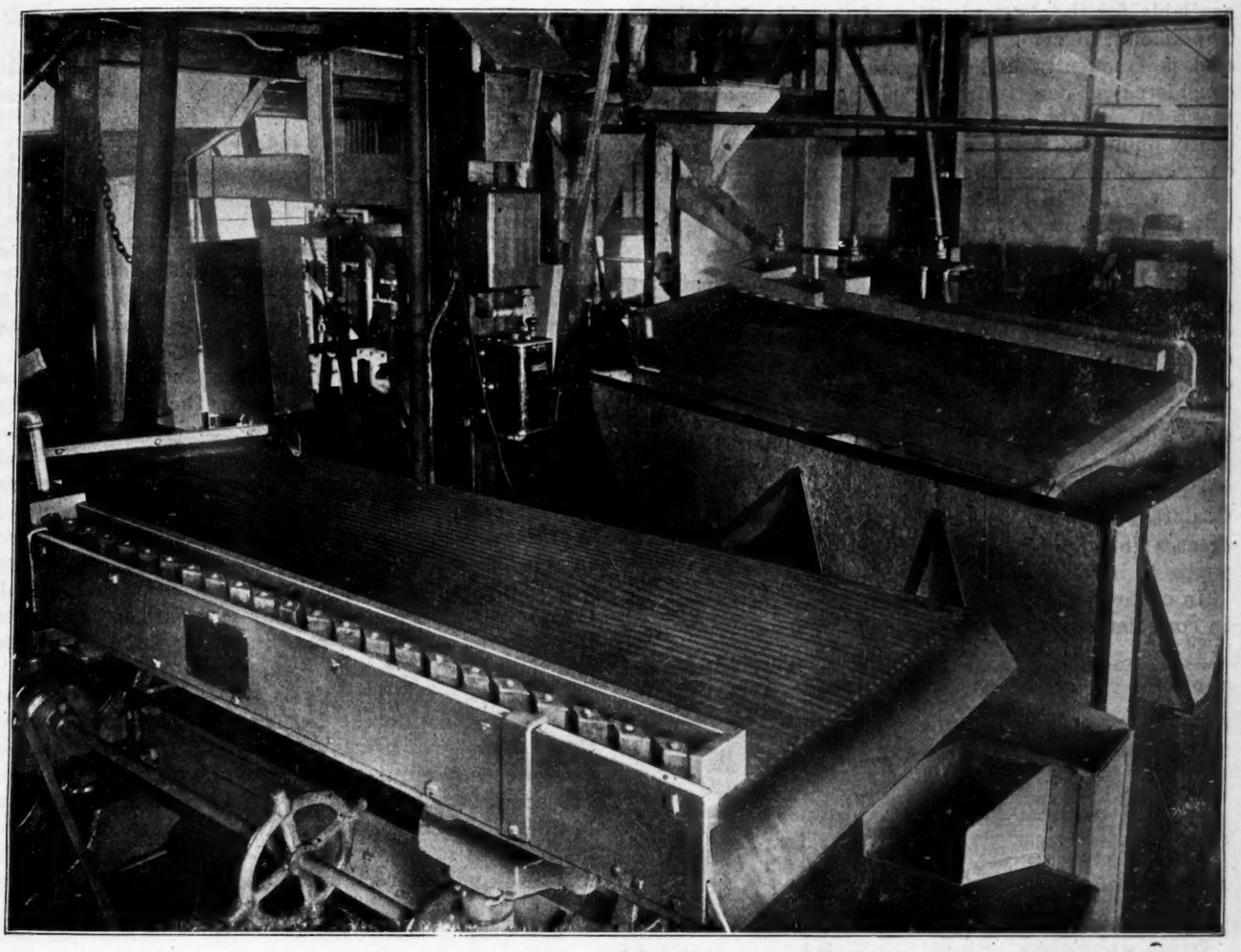

FIG. 1. TABLES IN THE COAL WASHING LABORATORY OF THE UNIVERSITY OF ILLINOIS

TABLE II. RESULTS OF SCREENING TESTS

Size	Cumulative Percentage, per Cent.
On ¼ inch	3.7
On 20 mesh	17.8
On 80 mesh	65.4
Through 80 mesh	34.6

[1]Coal Washing: A Scientific Study, *Transactions* Institute of Mining Engineers (1917-18), vol. 54, p. 419.

of the screening tests. By treating this coal on a washing table, the ash content was reduced from 12.8 per cent to 8.1 per cent and the sulphur from 1.7 to 1.5 per cent, with a recovery of 93.5 per cent of the feed as clean coal.

It is well known that sulphur occurs in coal in three forms, namely, as iron pyrite, as organic sulphur in combination with the coal substance, and as calcium sulphate. Until quite recently little attention has been given to the chemical forms of sulphur in coal. At present the technical men of the iron and steel, coke and gas-making industries are giving more attention to this subject. In the past it has been customary to consider "combined sulphur" as well as total sulphur in determining the improvement to be expected in a coal due to washing, but no accurate methods have been available for the determination of "combined sulphur." The amount of combined or organic sulphur present in coal is frequently underestimated; it has often been considered as constituting a negligible percentage of the total amount present. Powell and Parr[3] have recently published improved methods for determining the chemical forms of sulphur in coal. Their methods have been used in the present work. Table III shows the relative amounts of the different forms of sulphur present in five samples of coal from four states.

The samples given are not necessarily representative of the county or of the local field from which they were obtained. The results are tabulated for the purpose of calling attention to the amounts of the different forms of sulphur present, and especially to point out the high values for organic sulphur. The coals so far examined were all low in sulphate sulphur. It appears that this is true for most of the coals in the United States, with the exception of some occurring in the extreme West. Coal that has been in storage and has weathered, increases in sulphate sulphur, due to the oxidation of pyrite to iron sulphate.

In connection with the work on the forms of sulphur in coal, determinations were made on the original raw

TABLE III. FORMS OF SULPHUR IN RAW COAL VALUES GIVEN IN PERCENTAGE MOISTURE-FREE BASIS

Coal from	Total	Pyritic	Sulphur	Organic
Tennessee, White County	4.87	3.59	0.11	1.17
Per cent. of total sulphur	....	74.0	2.0	24.0
Kentucky, Pike County	0.46	0.3	....	0.33
Per cent. of total sulphur	....	28.0	....	72.0
Illinois, Williamson County	1.83	1.04	trace	0.79
Per cent. of total sulphur	....	57.0	....	43.0
Illinois, Franklin County	3.51	1.84	....	1.67
Per cent. of total sulphur	....	52.0	....	48.0
Indiana, Green County	1.66	0.89	....	0.77
Per cent. of total sulphur	....	54.0	....	46.0

coal samples and on some of the washed products. The reason for determining the different forms of sulphur was to note the effect of washing on the forms and the distribution of sulphur in the products. Analyses are given of two lots of coal. Table IV shows the results for a White County, Tennessee, coal and for samples representing a day's run at a 1200-ton commercial washery in Williamson County, Illinois. The five washed coals given are the various sizes produced at this washery. Sample *A* represents a small sample of the cleanest washed coal taken near the head end of the table during a test run in the laboratory.

[3]Forms in Which Sulphur Occurs in Coal. University of Illinois, Engineering Experiment Station, Bulletin, 111.

These results indicate that only pyritic and sulphate sulphur are removed by washing. Iron sulphate resulting from the oxidation of pyrite is soluble in the wash water. Gypsum occurring in thin plates is difficult to separate with the refuse. From these considerations it is believed that the sulphate sulphur of the White County, Tennessee, raw coal resulted from the oxidation of pyrite, rather than from the presence of calcium sulphate, since it is almost entirely absent in the clean washed coal. The organic sulphur content of the various products obtained by washing the same coal remains fairly constant, as was expected. It ap-

TABLE IV. FORMS OF SULPHUR IN RAW AND WASHED COAL PRODUCTS

Values in percentage-moisture-free basis

Product	Total, Sulphur	Pyritic Sulphur	Sulphate Sulphur	Organic Sulphur
White County, Tennessee:				
Raw coal	4.87	3.59	0.11	1.17
Table washed coal	3.02	1.84	Less than 0.01	1.18
Jig washed coal	3.80	2.61	....	1.19
Sample A	2.67	1.51	....	1.16
Williamson County, Illinois:				
Raw coal	1.83	1.04	trace	0.79
No. 1 washed coal	1.81	1.05	....	0.76
No. 2 washed coal	1.56	0.78	....	0.78
No. 3 washed coal	1.57	0.82	....	0.75
No. 4 washed coal	1.57	0.81	....	0.76
No. 5 washed coal	2.33	1.57	....	0.76

pears that by washing a coal high in clean shale a concentration of organic sulphur in the washed coal, and a corresponding reduction of organic sulphur in the refuse, would occur.

Attention is directed to the constancy of the values for organic sulphur in Table IV for the same coal. The lot of White County, Tennessee, coal weighed 700 lb. and the samples of Williamson County, Illinois, coal represented altogether about 1200 tons, yet the organic sulphur content of all the products for the same coal is practically the same. This tends to show that organic sulphur is uniformly distributed in the coal substance and that it is in chemical combination with the coal. Certainly the organic sulphur content of coal from the same mine is much more uniform than the pyritic and total sulphur values.

A specific gravity analysis showing the percentages of material of different densities in a raw coal crushed to the size at which it is to be washed is of considerable value for determining in a preliminary way what one may expect to accomplish by washing. Analyses of this kind are described by Pascal,[3] commenting on the methods of testing used by Beers of Liége, Belgium, and by David Hancock,[4] who used anlyses of this nature to determine the efficiency of jigs.

The graphs here presented show the analyses of a washable coal before and after washing, and of this washable coal compared with a raw coal which is difficult to wash. The first graph, Fig. 2, shows clearly what class of material is removed by washing. While particles heavier than 1.6 in specific gravity were practically all removed, particles between 1.3 and 1.6 in specific gravity are not appreciably affected by washing. The analyses given in Table V shows that this material is higher in ash and sulphur than is desirable in the clean coal, but lower than is desirable in the refuse. This represents the class of impurities described under "Physical Forms of Impurities" as difficult to remove, and is the product that appears at the

[3]*Colliery Guardian*, (Aug. 10, 1917), vol. 94, p. 252.

[4]Coal Washing in Alabama. Alabama Geological Survey Bulletin.

washery as "true middling." If the specific gravity analysis of a raw coal shows a large percentage of this material, it is extremely difficult to wash successfully. This condition is illustrated in the second graph, Fig. 3, comparing the raw coal of Fig. 2 with a coal much more difficult to wash. The total percentage between 1.3 and 1.6 specific gravity on the non-washable coal is 40, as compared with only 17 for the washable coal.

The ideal coal for washing would be represented by a graph showing all the material concentrated in the parts heavier than 1.60 and lighter than 1.30. Results of a washing test on the coal represented in Fig. 2 are given in Table VII. Table VIII gives the results of a test on the non-washable coal of Fig. 3. The specific gravity determination on these samples were made by separating the sample at 1.30 specific gravity with the Delameter sink and float machine and treating the sink in a succession of heavier solutions in beakers. The effect of the conditions described on the results attainable by washing is shown by washing tests on some typical coals.

This coal is represented in Fig. 2 and Table V, and is the washable coal of Fig. 3. The visible impurities consisted of pyrite bands and lenses as much as 1 in. in thickness; thin shale bands that hold together well in water; some fireclay; thin plates of pyrite in joint fissures; and an unusually large percentage of calcite and gypsum in the form of thin sheets. This coal was washed at 0 to ¼ in. size on a table. The results are given in Table VII.

The coal from White County, Tennessee, is represented in the graph of Fig. 3 as non-washable. A visual examination showed it to contain little clean shale or slate coarse enough to be liberated by crushing to the size at which coal is ordinarily jigged. Visible pyrite was present both as thin plates and as coarser bands or lenses. The difficulties in washing this coal were, as indicated by the graph, due to an exceptionally high percentage of material of intermediate density, indicating that the impurities are so fine that even when crushed to ⅜ in. size they are not liberated, and the exceptionally high ash and sulphur content of the lightest coal. The ash content of the part of this coal that

TABLE V. ANALYSES OF COAL REPRESENTED IN FIG. 2

Specific Gravity	Per Cent. of Total Sample	Ash, per Cent.	Sulphur, per Cent.	Per Cent. of Total Sample	Ash, per Cent.	Sulphur, per Cent.
1.30	73.35	4.64	1.72	85.50	4.77	1.63
1.30 to 1.35	8.74	11.27	2.14	8.30	11.8	2.06
1.35 to 1.40	4.93	17.78	2.39	3.70	17.9	2.13
1.40 to 1.45	1.82	20.32	2.52	0.88	18.5	2.36
1.45 to 1.50	0.39	24.60	2.62	0.27	23.6	2.55
1.50 to 1.60	1.12	29.90	2.80	0.54	28.3	2.84
1.60 to 1.80	2.13	49.53	3.43	0.34	48.8	3.76
1.80	7.52	84.04	13.63	0.57	80.3	7.07

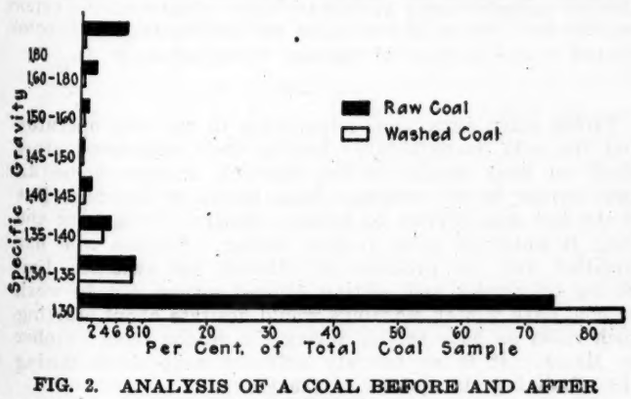

FIG. 2. ANALYSIS OF A COAL BEFORE AND AFTER WASHING

TABLE VI. ANALYSES OF COALS REPRESENTED IN FIG. 3

Specific Gravity	Washable Coal: Per Cent. of Total Sample	Washable Coal: Ash, per Cent.	Washable Coal: Sulphur, per Cent.	Non-washable Coal: Per Cent. of Total Sample	Non-washable Coal: Ash, per Cent.	Non-washable Coal: Sulphur, per Cent.
1.30	73.35	4.64	1.72	55.9	10.1	2.91
1.30 to 1.35	8.74	11.27	2.14	20.5	13.3	3.35
1.35 to 1.40	4.93	17.78	2.39	11.8	15.4	3.45
1.40 to 1.45	1.82	20.32	2.52	3.8	19.1	4.39
1.45 to 1.50	0.39	24.60	2.62	1.8	22.5	6.18
1.50 to 1.60	1.12	29.90	2.80	2.1	27.6	9.29
1.60 to 1.80	2.13	49.53	3.43	1.1	42.7	13.30
1.80—	7.52	84.04	13.63	13.0	60.5	34.12

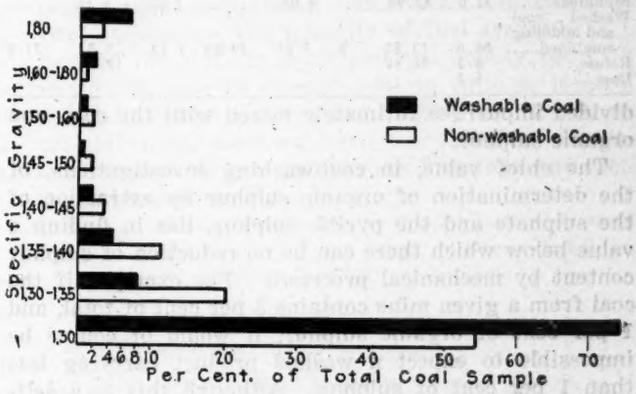

FIG. 3. ANALYSIS OF WASHABLE AND UNWASHABLE COAL

was lighter than 1.3 in specific gravity was 10.1 per cent, while the corresponding increment of the washable Illinois coal analyzed 4.64 per cent ash.

The Tennessee coal was crushed to ⅜ in. maximum size and treated on a washing table. Although a good

TABLE VII. WASHING TEST ON A COAL FROM WILLIAMSON COUNTY, ILL.

	Feed, Per Cent.	Ash, Per Cent.	Reduction in Ash, Per Cent.	Sulphur: Pyritic, Per Cent.	Sulphur: Reduction in Pyritic, Per Cent.	Sulphur: Organic, Per Cent.	Sulphur: Total Sulphur Per Cent.	Sulphur: Reduction in Total Sulphur, Per Cent.
Raw coal	100.0	14.2	..	1.94	..	0.76	2.70	..
Washed coal	85.0	7.2	49	1.09	44	0.76	1.85	32
Middlings	6.6	19.8	..	1.80	..	0.76	2.56	..
Washed coal and middling combined	91.6	8.1	43	1.14	41	0.76	1.90	30
Refuse	7.3	72.12	..	....	..	....	10.75	..
Loss	1.1	.....	..	....	..	....	.....	..

reduction in sulphur in the clean coal was secured, this was made possible only by taking a large middling product and a large refuse low in ash and sulphur. For these reasons the washing of this coal would not be profitable.

To sum up the conditions that characterize an easily washed coal, the excess undesirable sulphur and ash should be present in the form of shale or pyrite particles large enough to be detachable from the coal, without crushing finer than ¼ in. in size. The coal, when crushed to the proper size for washing, should be separable by a sink-and-float test into an increment heavier than 1.6 specific gravity and an increment lower than 1.30 in specific gravity and low in ash and sulphur content with only a small percentage of intermediate density between these increments. The impurities that make a coal difficult to wash are thin bands of friable shale; bony coal; carbonaceous shale; thin filmlike flakes of pyrite, calcite or gypsum in joint fissures; finely

TABLE VIII. WASHINGTEST ON A COAL FROM WHITE COUNTY, TENNESSEE

	Feed, Per Cent.	Ash, Per Cent.	Reduction in Ash, Per Cent.	Sulphur				
				Pyritic, Per Cent.	Reduction in Pyritic, Per Cent.	Organic, Per Cent.	Total, Sulphur, Per Cent.	Reduction in Total Sulphur, Per Cent.
Raw coal.....	100.0	15.15	..	3.60	.....	1.17	4.87	....
Washed coal...	54.6	11.30	25	1.85	51.5	1.17	3.02	38
Middlings.....	32.0	17.90	..	4.04	.....	1.17	5.22	....
Washed coal and middling combined.....	86.6	13.80	9	2.65	29.00	1.17	3.82	21.5
Refuse.....	8.2	36.39	..	....	.....	....	17.74	....
Loss.....	5.2	.....	..	....	.....	....	.....	....

divided impurities intimately mixed with the coal, and organic sulphur.

The chief value, in coal-washing investigations, of the determination of organic sulphur by extraction of the sulphate and the pyritic sulphur, lies in finding a value below which there can be no reduction of sulphur content by mechanical processes. For example, if the coal from a given mine contains 3 per cent of total, and 1 per cent of organic sulphur, it would of course be impossible to expect a washed product carrying less than 1 per cent of sulphur. Although this is a self-evident fact, it is of such importance in determining the washability of a coal that attention is directed to it. It would be inadvisable to give here a definite figure for the reduction in pyritic sulphur that can be expected with the best modern coal-washing machinery. The data given indicate that in some coals one-half of the pyritic sulphur may be removed, but the percentage reduction would vary markedly with different coals, depending on the physical form in which the pyritic sulphur occurs. In any case, the minimum sulphur content that may be obtained in the clean coal is well above the organic sulphur content, because some pyrite occurs in a finely divided state intimately mixed with the coal. For practical purposes in coal washing this, in addition to the organic sulphur, may be considered as fixed sulphur.

The experimental work here described was carried out under the general direction of E. A. Holbrook, acting chief mining engineer, U. S. Bureau of Mines.

The Coal Industry in 1917

The inventory of the nation's resources that the war made necessary brought to light many new facts about coal mining which will be of lasting value to the industry and to the public. As long as the war lasted these incidental lessons were lost sight of under the pressure of meeting the emergency created by the shortage of fuels, but with the return of peace the experience gained during the war is being gathered together in a series of reports on the industry, the first of which, "Coal in 1917," by C. E. Lesher, has just been published by the United States Geological Survey, Department of the Interior.

The period from 1914 through 1917 and 1918 and into 1919 may be regarded as a distinct epoch in the coal industry, of which the year 1917 represented only one section, but a section which, if not the most remarkable for its achievements, was at once the most chaotic and the most momentous in the history of the industry.

It is not difficult to marshal the events and factors that mark 1917 as unusual: An extraordinary demand, increasing after April, when this country entered the war, and unsatisfied throughout the year; high prices and speculation in "free" coal; the first effort at regulation of prices through the Committee on Coal Production; the Pomerene amendment to the Lever Act and the fixing of prices and appointment of the Fuel Administrator by the President; labor troubles; priority orders; car shortage and other difficulties in transportation; severe storms in December that blocked the railroads; the withdrawal of ships from the coastwise trade to New England; unequal distribution of coal and constant fear of a fuel famine in many sections; reluctance of many producers and distributors of coal to accept governmental regulations in general, and the program of the Fuel Administration as it was developed in particular.

In response to the unprecedented demand the bituminous mines produced 551,790,563 net tons, or nearly 10 per cent more than the output of the year before. The anthracite output was 99,611,811 net tons, an increase over 1916 of 13.7 per cent. The total output of both hard and soft coal was thus over 650,000,000 tons.

This record output was accomplished by a labor force of 603,143 men in the bituminous and 154,174 in the anthracite mines. In spite of the draft the number of workers in the bituminous industry was greater in 1917 than in 1916.

Material progress was made during the year in the introduction of the eight-hour day. Whereas in 1916 about 41 per cent of the bituminous workers were employed in mines where the standard working day was longer than eight hours, in 1917 the number in such mines had fallen to 21 per cent. The change was largely the result of reduction in working hours in Kentucky, Maryland, Pennsylvania (bituminous), Tennessee, Virginia and West Virginia, particularly in the larger non-union fields.

In response to numerous inquiries statistics were collected regarding the thickness of vein which it is profitable to mine. Many people will be surprised to learn that in 1917 more than 20,000,000 tons of soft coal was mined from beds less than 3 feet thick. The percentages drawn from each thickness of seam are shown in the following table:

Percentage of Total Output of Bituminous Coal and Lignite Produced From Beds of Different Thickness in 1917.

Under 2 feet	0.6
2 to 3 feet	3.2
3 to 4 feet	13.3
4 to 5 feet	17.6
5 to 6 feet	19.9
6 to 7 feet	13.8
7 to 8 feet	8.9
8 to 9 feet	5.3
9 to 10 feet	5.6
10 to 20 feet	2.0
20 feet or more	.3
Thickness not reported	8.5
	100.0

Two other new investigations published in the report will be of special interest to coal men—the use of mechanical devices for loading box cars and the production of coal suitable for manufacturing by-product coke. Copies of the report may be had free of charge upon application to the Director, United States Geological Survey, Washington, D. C.

THERE HAVE BEEN some advantages in the coal operator and the coke manufacturer having their employees start work an hour earlier in the morning and go home an hour earlier in the evening—from March to October. But if the law was revised to become effective throughout the year, it would be quite another matter. Anyone who has wrestled with the problems of thawing out switches, limbering up tipples and getting colored miners out to work on cold dark winter mornings would hesitate about starting such tasks an hour earlier during the season from October to March. It is an entirely different proposition during the remaining six months of the year.

Coals of Ohio and Their Limitations for Byproduct Coke*—II

By Wilbur Stout†
Columbus, Ohio

THE Allegheny is the most important coal-bearing formation. It extends in a belt from Mahoning County, on the north, across Stark, Cuscarawas, Coshocton, Muskingum, Perry, Hocking, Athens, Vinton and Jackson Counties to Lawrence County on the Ohio River. The thickness of the formation varies from 150 to 250 ft. and averages nearly 200 ft. It contains six well-defined coal beds, five of which have been mined in a large way. It begins with the Brookville, or No. 4, coal and ends with the Upper Freeport, or No. 7, member.

Brookville, No. 4, Coal.—The Brookville coal, the basal member of the Allegheny formation, lies directly below the Putnam Hill limestone where this member is present. This coal is locally developed in parts of Vinton, Coshocton, Tuscarawas, Holmes, Wayne and Stark Counties. The bed has been mined at only a few places for railroad shipment, but it has been worked in many localities for small supplies of domestic fuel. The largest field is in Stark and Tuscarawas Counties, where the bed is rather steady and from 3 to 6 ft. thick. The following section is about representative of the Brookville coal in the Canton district of Stark County:[3]

		Feet	Inches
Limestone, Putnam Hill		5	0
Coal	Brookville	3	0
Clay		0	2
Coal, bony		0	8
Coal		2	2

In Coshocton, Holmes, Wayne and Vinton Counties, the best deposits have a thickness of about 4 ft., but they are usually confined to a few square miles in extent. The bed is commonly broken by partings of clay and bone coal, which cause some trouble in keeping the fuel clean; otherwise the mining conditions are good. The quality of the Brookville coal is shown by the following analysis: Moisture, 5.29 per cent.; volatile matter, 39.10 per cent.; fixed carbon, 46.64 per cent.; ash, 8.97 per cent.; sulphur, 3.29 per cent.

The Brookville coal has weak cementing properties but is never low in sulphur or ash. The coal in the lower part of the bed is more impure than that in the upper part but neither is of first-class quality. As the sulphur occurs both in the form of pyrite and in organic sulphide, the fuel is but little improved by washing. Large quantities of Brookville coal are yet available but the quality excludes it from byproduct coke making.

Clarion, No. 4a, Coal.—In ascending order, the second coal bed in the Allegheny formation is the Clarion, or No. 4a, which lies either directly or only a few feet below the Ferriferous or Vanport limestone and from 20 to 35 ft. below the Lower Kittanning coal. It is present in the northeastern and southern parts of the state and is thin or wanting in the central part. Small deposits, varying from 3 to 4 ft. in thickness, have been worked in northern Columbiana County for railroad shipment. The quantity of fuel available in this part of the state is small and the quality poor. The important field of Clarion coal in Ohio is located in southern Vinton, eastern Jackson, eastern Scioto, western Gallia and northern Lawrence Counties. The area is large and the bed persistent. The following section is representative:

		Feet	Inches
Limestone, Ferriferous or Vanport		6	0
Shale		1	0
Coal	Clarion	1	3
Clay		0	7
Coal		1	4
Clay with pyrite		0	1
Coal		1	0
Clay, siliceous		2	0

The average thickness of clean coal is about 3 ft. 6 in. The bed is everywhere broken by the two partings and in places by thin layers of bone coal. The fuel produced by the ordinary methods of mining is dirty. An analysis of the coal is:[4] Moisture, 5.34 per cent.; volatile matter, 38.94 per cent.; fixed carbon, 44.92 per cent.; ash, 10.80 per cent.; sulphur, 4.33 per cent.

The Clarion coal cokes readily and yields a product of excellent structure, as shown by the results obtained at Vinton Furnace, Vinton County, in Welsh ovens. The ash and sulphur, however, are far above the limits demanded for coals for byproduct practice. Washing lowers the ash considerably but it is not particularly effective in reducing the sulphur, for about half of this is present in organic combination and the remainder in disseminated pyrite. Moreover, the yield of coke from such a coal is low. Although present in large quantities and coking freely, the Clarion coal is thus excluded from the field of byproduct coke on account of its high ash and sulphur.

Lower Kittanning, No. 5, Coal.—The position of the Lower Kittanning coal is normally 20 to 35 ft. above the Ferriferous limestone and 25 to 45 ft. below the Middle Kittanning coal. Although locally wanting, the member may be traced readily from the Ohio-Pennsylvania line in Columbiana County across Stark, Carroll, Tuscarawas, Coshocton, Muskingum, Perry, Hocking, Vinton and Jackson Counties to the Ohio River in Lawrence County. This member is an important source of fuel in a number of districts in the state, but the horizon is better known on account of the great bed of plastic clay associated with the coal. The Lower Kittanning is one of the few Ohio coals that cokes freely, but it has limitations due to detrimental impurities. It was coked in a small way for many years in the Leetonia field of Columbiana County. The product was somewhat brittle but otherwise had fair properties. The area is now largely exhausted hence it need not be considered further. In parts of Stark County, the bed is rather steady and from 3 to 4 ft.

*Concluding installment of a paper presented before the Chicago meeting of the A. I. M. E., September, 1919. First part appeared in *Coal Age*, , October 23, 1919.

†Assistant State Geologist.

[3]Ohio Geological Survey, 5, 232.

[4]Ohio Geological Survey *Bulletin* 9, 291.

thick. The following measurement is about representative of the best deposits:

		Feet	Inches
Shale		10	0
Coal	Lower Kittanning	1	10
Shale		0	2
Coal		2	0
Clay		6	0

In this county the analysis of the coal is, approximately, as follows: Moisture, 3.83 per cent.; volatile matter, 42.10 per cent.; fixed carbon, 50.22 per cent.; ash, 3.85 per cent.; sulphur, 2.25 per cent. The sulphur occurs largely as pyrite in concretionary form and hence the coal would be improved by washing. The quantities yet available, however, are not large.

The Lower Kittanning coal holds its thickness well and extends over a wide area in Tuscarawas County. The thickness varies from 2 ft. 6 in. to 5 ft. but averages somewhat over 3 ft. The quantities of fuel yet available are large. In parts of the fields, the bed contains considerable pyrite in large nodules or sheets, which are usually bedded along definite zones; washing would remove most of this. The following measurement is about an average for the field:

		Feet	Inches
Shale		10	0
Coal	Lower Kittanning	2	6
Shale with pyrite		0	2
Coal		0	6
Clay		9	0

The analysis follows: Moisture, 4.3 per cent.; volatile matter, 40.83 per cent.; fixed carbon, 46.67 per cent.; ash, 8.20 per cent.; sulphur, 3.43 per cent.

In a small field north of Newcomerstown, Tuscarawas County, the Lower Kittanning coal is quite pure, being low in both sulphur and ash. By choosing the best deposits of coal in the county, a fair grade of coke could be made, but the yield would be low, approximately 56 per cent. The byproducts, however, would be high and find a ready sale.

In Guernsey, Coshocton and Muskingum Counties, the Lower Kittanning coal is unsteady and generally of poor quality. The continuity of the bed is much better in Perry County, where large acreages are present in the northeastern and southern portions. The thickness of the bed varies from 3 to 5 ft. but averages nearly 4 ft. The section given below was obtained in Pike Township:[6]

		Feet	Inches
Shale		0	7
Coal	Lower Kittanning	0	6
Horn coal		0	1
Coal		1	0
Parting		0	1
Coal		1	9
Clay		1	0

The approximate analysis of the coal in Perry County is: Moisture, 6.9 per cent.; volatile matter, 38.53 per cent.; fixed carbon, 47.32 per cent.; ash, 7.25 per cent.; sulphur, 2.9 per cent.

Everywhere in the field the sulphur is high, seldom being below 2 per cent.; the improvement by washing would not be sufficient to give a first-class product. The ash in the coke, however, could be kept below 10 per cent.

In its extension southward, the Lower Kittanning coal is not important until Jackson and Lawrence Counties are reached; here the bed holds fair thickness over rather large areas, expanding from 2 ft. 6 in. to 5 ft. The average measurement and structure are shown in the following section:

		Feet	Inches
Shale		20	0
Coal	Lower Kittanning	2	4
Clay		0	2
Coal		0	6
Clay		6	0

The mining conditions are fair and with a little care the coal may be kept free from extraneous materials. The approximate composition is: Moisture, 6.43 per cent.; volatile matter, 38.34 per cent.; fixed carbon, 47.22 per cent.; ash, 8.01 per cent.; sulphur, 2.29 per cent. Carload samples of this coal washed and then coked in beehive ovens gave products with the following analysis:[6]

Volatile matter	2.95	2.60
Fixed carbon	86.60	88.85
Ash	10.45	8.55
Total	100.00	100.00
Sulphur	1.004	1.35

The Lower Kittanning coal was coked for years by the Ashland Coal and Iron Co. at Ashland, Ky. The coke produced was of fair quality but the yield was low. By mixing this coal with Pocahontas or other good grades of West Virginia coal, the yield would be increased and the quality of the product could be considerably improved. The Lower Kittanning member offers the best possibilities for coke making in the byproduct oven of any coal in southern Ohio.

Middle Kittanning, No. 6, Coal.[7]—Bownocker says:[6] "The Middle Kittanning coal, on account of its quantity and quality, is the most valuable in Ohio. It is found along the state line in Columbiana County and can not only be followed with ease across the state to Lawrence County, on the Ohio River, but it is worked in every county where it should appear above drainage and in most of them on a large scale." It has its maximum development in the Hocking Valley field in Perry, Hocking and Athens Counties. The bed lies from 25 to 45 ft. above the Lower Kittanning coal and from 80 to 100 ft. below the Upper Freeport member.

The Middle Kittanning coal is regularly present in the eastern and southern parts of Columbiana County, but it has an average thickness of less than 3 ft. The quality of the fuel, however, is good. It was coked for a number of years near Hammondsville, but as the cost of mining was high the operations were finally abandoned. The thickness and quality of this coal are also much the same in Stark County, where the best deposits are found in the eastern and southern parts. The Middle Kittanning coal is present above drainage over much of Tuscarawas County and is largely mined both for local purposes and for railroad shipment. The bed varies from 3 to 5 ft. in thickness. The average measurement is about as follows:

		Feet	Inches
Shale		10	0
Coal	Middle Kittanning	2	4
Shale		0	2
Coal		1	3
Clay, siliceous		3	0

[5]Ohio Geological Survey *Bulletin* 2, 187.

[6]Ohio Geological Survey *Bulletin* 20, 386.

[7]U. S. Geological Survey, *Professional Paper* 100-B, 49.

In places, a few inches of bony coal appears above the main bed. Thin partings are also present in both the upper and lower benches of coal in some mines. The average composition of the fuel is: Moisture, 3.76 per cent.; volatile matter, 41.31 per cent.; fixed carbon, 48.16 per cent.; ash, 6.77 per cent.; sulphur, 3.85 per cent. This analysis shows that the sulphur is far too high for byproduct coke. Washing improves the coal considerably but not to the extent necessary for good results. The thickness and composition of the Middle Kittanning coal in Coshocton and Muskingum Counties are much the same as in Tuscarawas. The quantities of fuel available in both counties are large and the mining conditions excellent. In the Hocking Valley district of Perry, Hocking and Athens Counties, the bed has excellent continuity and swells to 5 ft. or more in thickness. It is regularly present in three benches, which in places are further separated by irregular bony layers. On the average, the Middle Kittanning coal in this district is lower in sulphur than it is elsewhere in the state. The structure of the coal in the main part of the field follows:

		Feet	Inches
Shale		10	0
Coal	Middle Kittanning...	1	8
Shale and bone coal		0	6
Coal		2	0
Shale		0	4
Coal		1	6
Shale		0	1
Coal		1	6
Clay, siliceous		3	0

The average composition is: Moisture, 7 per cent.; volatile matter, 34.91 per cent.; fixed carbon, 51.38 per cent.; ash, 6.71 per cent.; sulphur, 1.32 per cent. In part of this field, the sulphur in the coal is less than 1 per cent. and the ash less than 6 per cent.; these could be considerably lowered also by washing. From clean coal, the yield of coke would be nearly 60 per cent. and the sulphur not above the standard of 1 per cent. The limitation, however, in the main Hocking field is that, as a whole, the Middle Kittanning coal has little coking power. The lower bench cements fairly well but the two above are lacking in this property. Satisfactory results could be obtained only by mixing it with some standard coking coal such as Pocahontas. Using a mixture of one-half Hocking Valley and one-half Pocahontas No. 3, the yield in coke would be approximately 71.28 per cent.,* the composition of the coke is: Volatile matter, 1.4 per cent.; fixed carbon, 90.59 per cent.; ash, 8.01 per cent.; sulphur, 0.67.

By washing the Middle Kittanning coal, the ash could be lowered somewhat and the sulphur kept safely within the limits required. The byproducts, especially the excess gas, would have a ready market. Under such conditions, the Middle Kitanning coal in the Hocking Valley field has more favorable prospects for coke making than it has elsewhere in Ohio. The quantities of coal yet available are large and a constant supply assured. South of this field, in Vinton, Jackson, Gallia and Lawrence Counties, the Middle Kitanning coal is thin and patchy, the best areas being only a few square miles in extent. Further, the quality of the fuel is generally poor.

Lower Freeport, No. 6a, Coal.—The Lower Freeport coal, lying about midway in the interval between the Middle Kittanning and Upper Freeport members, is unsteady in Ohio. The only two areas worthy of consideration are near Steubenville and Amsterdam, Jefferson County, where it is mined in a large way. The average thickness of the bed in the Steubenville region is nearly 4 ft. The quality of the coal is shown in the following analysis: Moisture, 2.06 per cent.; volatile matter, 39.06 per cent.; fixed carbon, 53.96 per cent.; ash, 4.92 per cent.; sulphur, 1.79 per cent.

In this district, the Lower Freeport coal was formerly coked quite extensively for the local furnaces but at present is not so used. The product was not up to the present standard as the coke was rather brittle and dense and high in sulphur and ash. The composition is approximately as follows: Volatile matter, 1.34 per cent.; fixer carbon, 91.28 per cent.; ash, 7.38 per cent.; sulphur, 1.97 per cent. The area of coal in the Amsterdam field is large and the thickness of the bed from 3 to 6 ft. The sulphur content, however, is more than 2.50 per cent. too high for coke making.

Upper Freeport, No. 6, Coal—The Upper Freeport coal, the youngest member in the Allegheny formation, extends from the Ohio-Pennsylvania line, in Columbiana County, southwesterly across the state to the Ohio River, in Lawrence County. The bed lacks persistency but at that it ranks third in importance. In general the fields are not large and are more or less disconnected. In Columbiana County, the Upper Freeport coal has been mined for many years near East Palestine and Salineville and the fields are yet far from exhaustion. The normal thickness of the bed is between 5 and 6 ft. The structure is shown by the following section:

		Feet	Inches
Sandstone, Mahoning		0	0
Shale		3	0
Shale, black		1	0
Coal	Upper Freeport	4	4
Shale		0	2
Coal		1	0
Clay		4	0
Limestone		2	0

The coal in the upper bench contains less sulphur and ash than that in the lower bench, which in places is not removed from the mine. It cokes freely but the product is of poor quality owing largely to the percentage of sulphur. The composition of the fuel is: Moisture, 2.32 per cent.; volatile matter, 39.08 per cent.; fixed carbon, 52.78 per cent.; ash, 5.82 per cent.; sulphur, 2.88 per cent.

The Upper Freeport coal has excellent thickness in the southwestern part of Carroll County but the best of the field is now exhausted. But little coal of value is found on this horizon in Tuscarawas County. The most important field, in Ohio, is the Cambridge, Guernsey County area, where the bed has been extensively mined for many years. Large quantities of coal, however, are yet available. The structure follows:

		Feet	Inches
Shale		3	0
Coal	Upper Freeport	4	1
Shale		0	2
Coal		1	7
Clay		3	0

The quality of the coal is shown by the analysis: Moisture, 4.11 per cent.; volatile matter, 36.5 per cent.; fixed carbon, 54.39 per cent.; ash, 5 per cent.; sulphur, 1.30 per cent.

*The average composition of 38 analyses of Pocahontas No. 3 coal given in West Virginia Geological Survey, Vol. II, 1903, pp. 695-6 is as follows: Moisture, 0.26 per cent.; volatile matter, 17.27 per cent.; fixed carbon, 77.77 per cent.; ash, 4.7 per cent.; sulphur, 0.62 per cent. These figures are used in the foregoing calculation.

This coal has been successfully used in the byproduct oven, but the structure of the coke is not up to the standard. By mixing it with other coals, more satisfactory results should be obtained. When coked alone, the yield is about 60 per cent. and the sulphur not above 1.25, which may be considerably lowered by careful selection and preparation. This field has possibilities for byproduct coke plants that are worthy of investigation.

The Upper Freeport coal is also present in Muskingum, Perry, Hocking, Athens, Vinton, Jackson, Gallia and Lawrence Counties, but the areas are usually small and the best of the fuel largely exhausted. The most productive regions are in central Muskingum and northern Athens Counties. The thickness of the bed is from 2 to 6 feet.

The Conemaugh formation in Ohio contains at least six well-defined coal beds, some of which are remarkably persistent. They are everywhere thin, seldom expanding to as much as 3 ft. and usually measuring about 1 ft. With few exceptions, these coals are dense and highly volatile and contain a large percentage of sulphur, which is combined largely with the organic matter. On the whole, they offer no possibilities for coke making.

The Monongahela formation outcrops in a broad belt extending along the Ohio River from Jefferson County to Lawrence County. The total area both above and below drainage is approximately 3000 square miles, and the average thickness more than 200 ft. The formation is of interest chiefly for its coal beds, which in ascending order are Pittsburgh, Pomeroy, Meigs Creek, Uniontown and Waynesburg.

Pittsburgh, No. 8, Coal.—The Pittsburgh coal, lying at the base of the Monongahela formation, outcrops over a wide area in Ohio, but the member has workable thickness only in three fields, which are widely separated. In its extension from the great districts in Pennsylvania into eastern Ohio, this coal increases in sulphur and ash, loses in coking and heating qualities, and shrinks in thickness. In importance, however, the Pittsburgh coal ranks second in this state, being surpassed only by the Middle Kittanning member.

The most important field is the Belmont, where the bed has excellent thickness and continuity over nearly the whole area. Although coal has been mined here since 1825, the quantities yet available are sufficient to last for many years. At present this county is the largest producer in the state. The thickness of the bed is from 2 to 6 ft., while the typical structure is as given below:

		Feet	Inches
Shale		8	0
Coal		1	0
Shale		0	10
Coal		2	3
Shale		0	¼
Coal	Pittsburgh	0	2
Shale		0	1
Coal		1	5
Shale with pyrite		0	1½
Coal		1	3
Clay		3	0

The structure varies somewhat from place to place but the bed always has a few thin partings, which are not especially troublesome in mining. The coal is bright and solid. The general character is shown by the following analysis: Moisture, 3.74 per cent.; volatile matter, 36.94 per cent.; fixed carbon, 50.08 per cent.; ash, 9.24 per cent.; sulphur, 4.29 per cent. Taking the bed as a whole, this analysis shows that both the sulphur and the ash are entirely too high for byproduct coke. Some parts of the deposit are purer than others, but even by careful selection and working this coal will make only a low-grade coke. The structure of the product, however, is very good.

In the Federal Creek field, which lies in the southwest corner of Morgan County, and in the northeast part of Athens County, the Pittsburgh coal is mined for railroad shipment. The bed varies from 3 to 6 ft. in thickness and, besides thin partings, is regularly divided by a structure of clay about 1 ft. thick. Attempts were made to coke this coal for the general market, but owing to mining troubles and to the poor quality of the product the result was a failure. In this field, the sulphur is seldom below 2.50 per cent. or the ash below 6 per cent.

The third field of Pittsburgh coal lies in southern Gallia County, but the area is small and the coal of poor quality. It is not mined except for local use.

In summarizing the points in reference to the Pittsburgh coal, the main facts are: The quantities of coal available are large; the mining conditions are good; and the coal cokes freely. But, the sulphur and ash are too high to yield a suitable coke for metallurgical use.

Pomeroy, No. 8a, Coal.—The second coal bed in the Monongahela formation is the Pomeroy, which lies from 25 to 50 ft. above the Pittsburgh coal and about the same distance below the Meigs Creek member. The only field of importance is in Meigs County, where this coal has been mined for shipment by rail and water for many years. The area yet available is not large. The bed contains some shaly coal in the upper part but otherwise is free from partings. The general thickness is between 4 and 5 ft., and the mining conditions are good. The composition is: Moisture, 6.79 per cent.; volatile matter, 34.91 per cent.; fixed carbon, 47.72 per cent.; ash, 10.58 per cent.; sulphur, 2.42 per cent. The minimum in sulphur is about 1.50 per cent. and in ash about 7 per cent. On account of the high ash and sulphur, the poor structure of the coke, and the low yield attained, the Pomeroy coal is outside the field of byproduct work. Moreover, careful selection and thorough washing will scarcely improve the quality sufficiently for satisfactory results.

Meigs Creek, Sewickley, No. 9, Coal.—The Meigs Creek coal, which is correlative with the Sewickley of Pennsylvania, lies from 60 to 100 ft. above the Pittsburgh bed and is of workable thickness in parts of Belmont, Harrison, Monroe, Washington, Noble, Morgan, Muskingum, and Guernsey Counties. This coal is variable in thickness, structure, and composition. It swells from 2 to as much as 6 ft. in height but averages about 4 ft. The bed is usually divided by one or more partings of bone coal, shale or clay, and also contains thin, closely spaced, papery layers of shaly material. The average composition, shown by nineteen analyses, is as follows:[9] Moisture, 4.11 per cent.; volatile matter, 36.03 per cent.; fixed carbon, 48.26 per ceit.; ash, 11.60 per cent.; sulphur, 4.28 per cent. As about half the sulphur is in organic combination and as much of the ash is uniformly distributed through the coal, the improvement by washing is not large. Although the field is large, the Meigs Creek coal gives no promises for coke production.

Uniontown, No. 10, Coal.—The Uniontown coal is present over a wide area in southeastern Ohio but is

[9]Ohio Geological Survey, (4), *Bulletin* 9, 301.

best represented in Belmont and Monroe Counties. The best deposits are from 3 to 5 ft. thick, but they are confined to rather small areas. The coal is generally high in ash and sulphur, and therefore not fitted for coke making.

Waynesburg, No. 11, Coal.—The Waynesburg coal, although found in several counties in southeastern Ohio, is of little importance as the bed is thin and uncertain and the fuel poor in quality. It is mined chiefly by the farmers for domestic purposes.

Rocks laid down during Dunkard time are found in a narrow belt extending along the Ohio River from Belmont County to Meigs County. The maximum thickness of the series is more than 600 ft. Several coal beds are present but these have little or no value. The Waynesburg "A" and Washington members are best developed and have been mined in places for local supplies of fuel.

SUMMARY

Owing to the importance of the iron and steel industry in this state and to the number of byproduct ovens well distributed over the area, the needs for local coking coals are great but are not satisfactorily supplied. The quantity of coal available is sufficient to last for many years, but the general quality is below the standard demanded for making metallurgical coke. The best possibilities lie with the Lower Kittanning, Middle Kittanning and Upper Freeport members in certain fields in which the impurities are below the average. Refined methods of picking and working will also add to the supply. If the local coals are used alone, the yield of coke is rather low and the structure at best only fair; but if mixed with high-grade coals from Pennsylvania or from West Virginia, the resulting product will be safely within the limits of usefulness. The limitations are such that the many failures to make coke in beehive ovens were not without cause.

Mining Methods in Great Britain

Published statements with regard to the coal industry in Great Britain which reflect on mining methods employed there have called forth the following comment from George S. Rice, the chief mining engineer of the Bureau of Mines:

Those who either do not visit the mines, or are not mining men, do not understand that undercutting machinery is not so generally applicable under European conditions as it is in the United States. The coal beds there are generally pitching, are faulted and are so deep that (a) in a large proportion of the working places these are too irregular and the pitch so great as to make it difficult if not impossible to use undercutting machines effectively or at all. (b) There is no more labor in picking from the face than there is in breaking the large lumps of the comparatively hard coal in the majority of the mines in the United States; in fact, in many cases machines would be "buried" by the spalling off of coal under the roof pressure. (c) Generally, the European coal mines use the very commendable system of longwall mining, which recovers practically all of the coal and fills the excavation with packing, instead of the practice which prevails in the United States of using the room-and-pillar system, in many places without attempted recovery of pillars. It is estimated that on the average, at least 25 per cent. of the coal is lost in the mining in this country. But room-and-pillar work does permit freer use of undercutting machines and cheap mining.

I do not mean to say that the equipment cannot be improved, just as it can be improved in most mines in the United States, but it is a mistake to compare the percentage of coal undercut in the United States with that in England or other European countries as a reflection on European methods.

As regards the alleged cutting of piece rates by the owners whenever the miners tried to see how much they could produce, I very much question this as a general fact; it is not common sense that they would do so.

Poorer seams—"It is undeniably true that mine owners have been working the poorest seams in order to escape the excess profits tax,"—this from my observation is not so, and it does not seem reasonable. The fact that poor seams are worked at all should be commendable instead of the practice which prevails in the United States, and regretted by mine operators, that on account of competitive conditions, only the best seams are worked, and which frequently sacrifices or leaves thinner or poorer areas of the coal.

I have observed in mines in the Midddle West areas with coal of from 4 to 5 ft. thick permanently left in a mine because there was 7 to 9 ft. of coal elsewhere, and the miners would not take the thinner coal without such an increased rate that the coal could not be produced at a competitive figure.

Mr. Rice analyzes the causes of shortage and presents them as follows in the order of their importance: (a) Strikes. (b) Letting-up of the miners in the amount of work they have been doing in a shift, on the ground that their day has come and they are no longer going to work as hard as they did in the past. (c) Voluntary absenteeism as shown by the official statistics. (d) Shortening of the hours of labor.

And on top of this came (July 16) the Sankey award, reducing by one hour the hours of labor, and which according to the best mining authorities in Great Britain is going to make a most serious reduction in the output.

British Fuel Experiments

The fuel research station at East Greenwich is expected to be completed immediately, states Trade Commissioner Henry F. Grady, London, in a recent Commerce Report, and operations will be commenced without delay. The central tower, a steel structure, which forms the starting point of the coal's treatment, is being placed in position. The offices and laboratories are complete, and gas holders are all ready. To supplement the power plant, electrical throughout, the Admiralty has supplied a Diesel engine taken from a British submarine.

The station is stated to embody a unique system for accurately determining the fuel value of coal and its products. Exact tests are to be carried out with special boilers of the comparative efficiency of coal, gas and oil in the furnaces. Experiment will be particularly directed to ascertain the maximum capacity of coal to yield motor spirit. It is not intended to deal at once with colliery refuse, but to confine work for the moment to standard coal. The station is an experimental one established by the British Government to ascertain the extent to which low-grade coal and colliery waste can be utilized to increase the country's supply of domestic and industrial fuel.

In many mine explosions all of the local officials have either been lost or imprisoned within the mine, leaving no official outside with authority to direct affairs. The senior official in authority on the outside of the mine following an explosion, or in his absence some employee who has previously been instructed as to the proper procedure in case of disaster, should assume charge in order to effect a preliminary organization for the rescue work.—*Rescue and Recovery Operations in Mines.*

Outdoor Substations in Connection with Coal-Mining Installations*

By H. W. Young
Chicago, Ill.

DEVELOPMENT of high-tension outdoor stations during the past few years has been due primarily to economic reasons. The demand for power in small communities could not be met with the conventional and comparatively expensive indoor types unless the rate for service was materially increased. That the various problems incident to development have been solved successfully, it is only necessary to point to the wide adoption of outdoor substations by utility companies. Passing at once to the question as to whether outdoor substations are applicable to the power requirements of coal mines, it is well to consider first the elements entering into their construction.

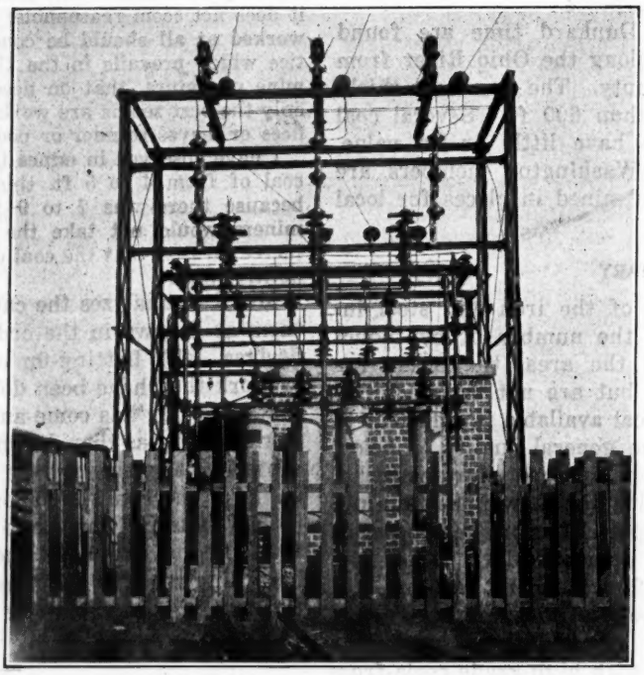

FIG. 1. SUBSTATION TAPPING POWER LINE GIVING SERVICE TO A COAL MINE

Self-cooled outdoor transformers are no longer an experiment. The chief difference between an indoor and an outdoor transformer lies in the type of bushings and cover. The outdoor type is commercially available in any desired capacity or voltage.

There are two distinct types of high-tension switches, the oil-break and the air-break forms. The oil-break switches are simply a development of the indoor types, the principal difference being in housings and terminals. They are thoroughly developed and in successful operation. Air-break switches are an accepted standard for transmission systems and are available in several forms. When provided with arcing horns or discharge horns, they can be used to open loaded circuits.

Outdoor types of electrolytic, oxide film and horn-gap arresters with or without limiting resistance are fully developed and have good service records. Outdoor choke coils are of the same general design as the indoor type with the exception of the insulating supports. The modern high-tension fuses can be used equally well indoors or outdoors, the only difference being that the outdoor mountings have petticoat instead of pillar-type insulators. High-tension wiring supports are standard commercial devices. Like the indoor types, they are made in many forms and assembled to meet the various wiring conditions.

If indoor equipment is to be used, a building must be erected with wall or roof bushings for the high tension incoming lines. This building must first be designed for the particular location, hence the services of an architect and a contractor are required. In other words, to properly protect equipment, a very considerable expense must necessarily be incurred that does not materially add to the operation of the electrical equipment. If outdoor equipment is selected, it is necessary to provide a supporting structure for only part of the electrical equipment; the transformers and oil switches simply require a foundation slab. The supporting structure is composed of steel sections fabricated in a factory and shipped with the equipment, thus eliminating the expense of the architect and contractor, necessary with the indoor station.

The outdoor substation steel structures are of simple design and can be erected by common labor under the direction of a foreman connected with the electrical department of the mine. The steel-tower outdoor substation does not require much foundation preparation but can be erected on small concrete pillars on the side of a hill, on a piece of waste ground, or the like.

The general design of outdoor substations has been thoroughly standardized, the actual assembly of elements depending upon local conditions to be met. Where two sources of power, such as a double-circuit transmission line, are available proper switching arrangements must be provided. A standard design for connecting transformers to either or both of two parallel and synchronous lines is shown in Fig. 4.

At the top of the tower are mounted two sets of three-pole, double-break-per-phase, air-break switches provided with separate interlocked operating mechanisms. Each switch has its own operating shaft and a handle so located that opening and closing the switch can be accomplished from ground level. In the high-tension side of the transformer wiring are located three single-pole combination choke coil and fuse units. On the opposite side of the tower are mounted three fused disconnecting switches connected to the separately mounted three-phase lighting arresters. From the one-line diagram, the connections can be easily traced. The choke coils are so located that incoming high voltage surges or lightning disturbances are reflected to the arresters, where they will be discharged in the usual manner.

*Paper presented before the Chicago meeting of the American Institute of Mining Engineers, September, 1919.

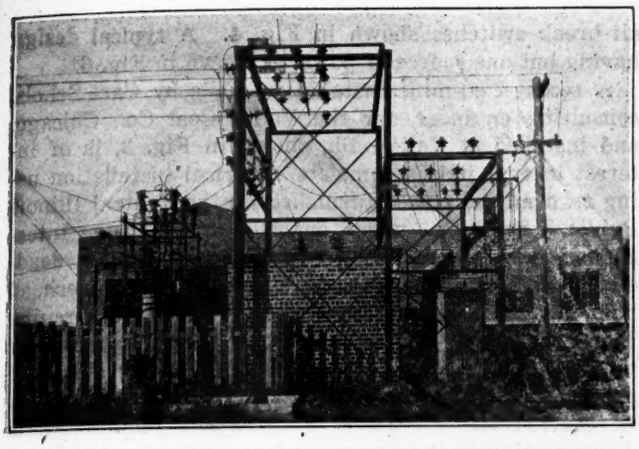

FIG. 2. VIEW OF AN OUTDOOR SUBSTATION

An important feature of this design is in the elimination of an expensive automatic oil circuit breaker on the high-tension side. That this saving can be made without jeopardizing the transformers is not generally understood by purchasers who often needlessly specify their use. It is essential that the expense be kept to the lowest possible value consistent with safety and good operation. As there is quite a difference in the cost of substations using automatic circuit breakers and air-break switches with fuses, the question immediately arises as to whether we can afford to use this lower-cost equipment.

It is conceded as a fact that the severity of damage done to transformers during short-circuit conditions is in direct proportion to the amount of energy flowing into the circuit before the transformers are disconnected. Whether an automatic oil switch or a fuse will clear the short circuit in the least time can be answered as follows: High-tension automatic oil switches of good design will open in approximately 0.16 sec. under short-circuit conditions. High-tension fuses of good design will clear short circuits in approximately 0.013 sec. or from ten to twelve times as rapidly as the automatic oil switches.

High-tension fuses will, under short-circuit conditions, permit a current flow many times the full load rating. Assuming that the current flow with automatic oil switches will be no greater and by comparing the time elements of the fuses (0.013 sec.) and the time element of the automatic oil switches (0.16 sec.), it follows that the slower operating switch will allow approximately twelve times more energy to flow into a short circuit than will flow with the faster operating high-tension fuse. In considering the foregoing values, it should be borne in mind that the amount of reactance in the circuit including that of the transformers will limit the actual current flow with either device.

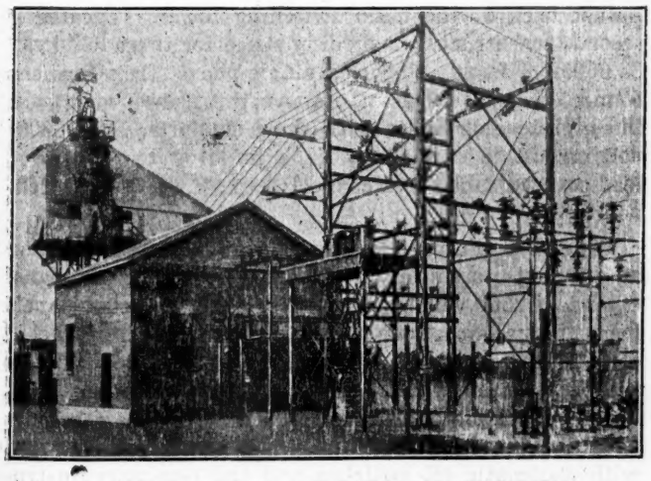

FIG. 3. VIEW OF THE SCHOLZ SUBSTATION

The oscillogram record, Fig. 5. illustrates this point. This particular test was made by connecting two 9000-kva. in parallel, short-circuiting one phase to ground on a 63,500/110,000-volt star-connected system. The total reactance approximated 20 per cent. and the current flow with this 5-amp. fuse was 240 amperes.

The exceptionally rapid action of fuses will therefore permit overfusing the transformers theoretically twelve times the normal current and still secure protection equal to that of an automatic oil switch. In actual practice overfusing from three to ten times normal is used depending upon local conditions. For power circuits subject to wide fluctuations, such as mining loads, the high-tension circuit-opening devices should be so rated or adjusted that they will not operate except in case of actual trouble, such as transformer failure. Such cases are rare with modern transformer designs.

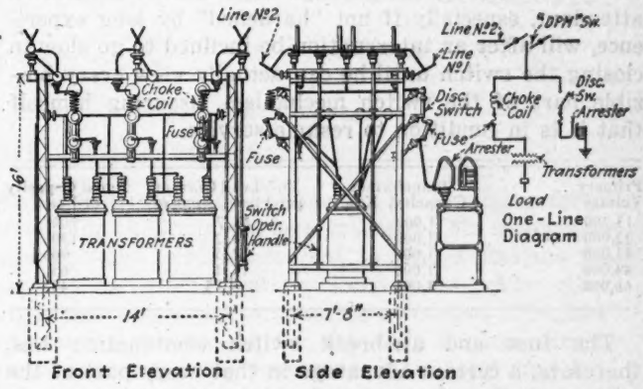

FIG. 4. STEEL TOWER SUBSTATION WITH TRANSFORMER TYPE SWITCHES FOR CONNECTING TRANSFORMERS TO EITHER OR BOTH OF TWO PARALLEL AND SYNCHRONOUS LINES

Such overload protection as is desired can be secured easily and cheaply by means of a low-tension automatic oil switch installed on the secondary side of the transformer bank. In substation practice, this combination of heavy high-tension fuses on the primary side, which will only open in case of transformer failure, and a properly adjusted oil circuit breaker on the secondary side of the transformer bank is an excellent protective system of which advantage is often taken.

The high-tension automatic oil switch has the advantage that it can be used for switching in addition to the overload feature. When fuses are used, it is necessary to install an air-break switch to disconnect the transformers from the line. In actual practice, however, it is often advisable and is considered good engineering practice to install disconnecting switches between the oil switch and the line. The reason for this is that the oil-switch contacts are necessarily concealed in the tanks and to be absolutely sure that a line is clear the disconnecting switches should be opened, thus giving the operator ocular evidence of disconnection.

Should the oil switch open frequently or under severe load conditions, it is advisable to inspect the contacts, oil levels and condition of the mechanism. To enable

inspection adjustments or repairs, it is often advisable to install auxiliary disconnecting switches so connected that the oil switches can be shunted and entirely disconnected from the circuit, power being temporarily delivered through the auxiliary switches.

Another point in favor of the oil switch is that after interruption it can, if in good condition, be immediately closed, thus reducing the time of service interruption. It will naturally require more time to open an air-break

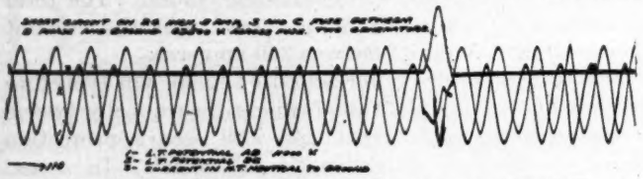

FIG. 5. OSCILLOGRAM RECORD OF 66,000-VOLT SHORT CIRCUIT

switch and replace fuses than it will to close the oil switch. The saving of a moment's time may in some instances warrant the additional expense of the oil switch. However, the average high-tension substation attendant, especially if not "hardened" by long experience, will after an interruption be inclined to go slow in closing the switch until he can actually view every possible part of the switch mechanism, assuring himself that it is in condition to resume service.

Primary Voltage	Transformer Capacity, Kva.	Full-Load Current per Phase, Ampees	Rated Capacity of Fuses
13,200	1,000	43.7	200
22,000	1,000	26.2	130
33,000	1,000	17.5	90
44,000	1,000	13.1	65
66,000	1,000	8.75	45

The fuse and air-break switch combination has, therefore, a certain advantage in that every part of the units, including contacts and condition of fuses, are in plain view of the attendant. The average man working on high-tension equipment has considerably more confidence if he can, without the shadow of a doubt, determine its condition at all times. The choice of equipment must finally rest with the purchaser but as a guide in determining in a general way the dividing line be-

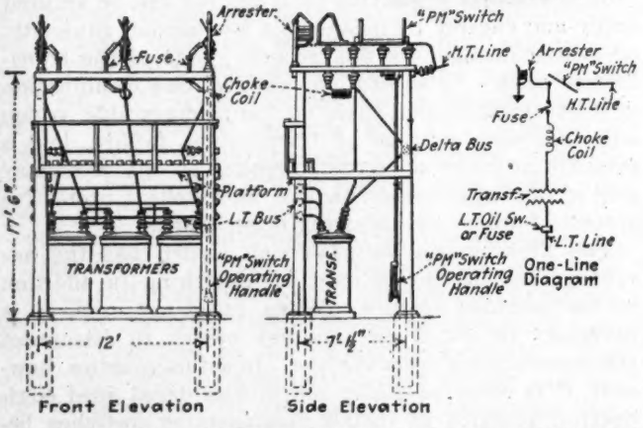

FIG. 6. TYPICAL SINGLE-CIRCUIT OUTDOOR SUBSTATION WITH LARGE CAPACITY TRANSFORMERS AT GROUND LEVEL

tween the use of high-tension fuses and oil breakers, the above tabulation of substation capacities on which fuses can be advantageously used when automatic oil breakers are installed on the low tension side, is given.

When but a single source of power is used, the substation is simplified by omitting one of the three-pole air-break switches shown in Fig. 4. A typical design having but one source of power is shown in Fig. 6.

A recent coal-mine installation made by Carl Scholz, consulting engineer, for the Valier Coal Co., Chicago, and installed at Valier, Ill., shown in Fig. 3, is of interest in that it is a complete electrical installation using transmitted power furnished by the Central Illinois Public Service Co., which operates an extensive interconnected system. The incoming power line is dead-ended to the steel tower, and by means of an overhead bus, taps are made to the arrester and load circuits. Three choke coils are so located that they offer a barrier to incoming lightning disturbances reflecting abnormal potentials to the arrester where they can be discharged. In the arrester circuit is a three-pole remote-control disconnecting switch operated by means of a handle at ground level. Below the choke coils is installed a three-pole disconnecting switch of the same type used in the

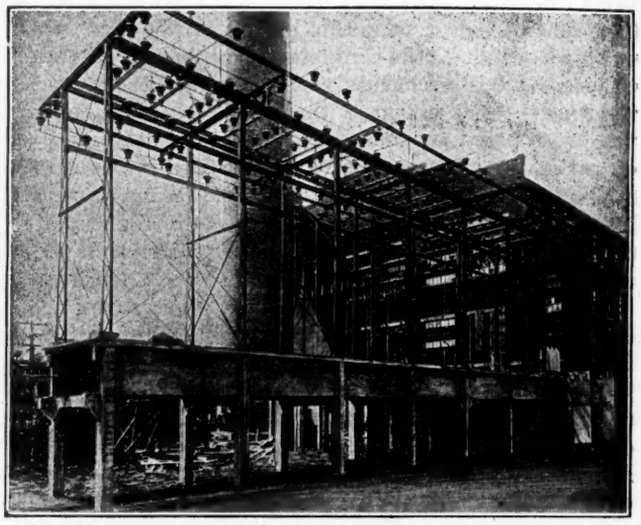

FIG. 7. SUBSTATION INSTALLATION OUTSIDE A POWER HOUSE

Twenty-one coal mines are supplied from lines leading from this installation

lightning-arrester circuit. Below this switch are three single-pole fuse mountings with fuses so rated that they will not blow except in case of transformer failure. The 33,000-volt primary metering equipment is located below the fuses, the current and potential transformers together with the watthour meter and demand indicator being a self-contained unit.

Just back of the main switching tower is located a second steel structure affording space for three 667-kva., 33,000/2,300-volt, 60-cycle, single-phase transformers connected in closed delta. Above the transformers are the high-tension buses with their supports. The 2300-volt circuit is carried into the building by means of lead-covered cables and connected to a five-panel switchboard.

Panel 1 is equipped with a 2300-volt check meter and an automatic main oil circuit breaker. From this panel extends a 2300-volt bus located back of the other panels permitting connections to the various loads. Panel 2 controls the main underground feeder; panel 3 controls the 1350-hp. main hoist motor; panel 4 controls a 250-hp. air-shaft motor; and panel 5 controls the machine-shop and yard-lighting line. Each panel is equipped with automatic oil switches and the necessary instruments.

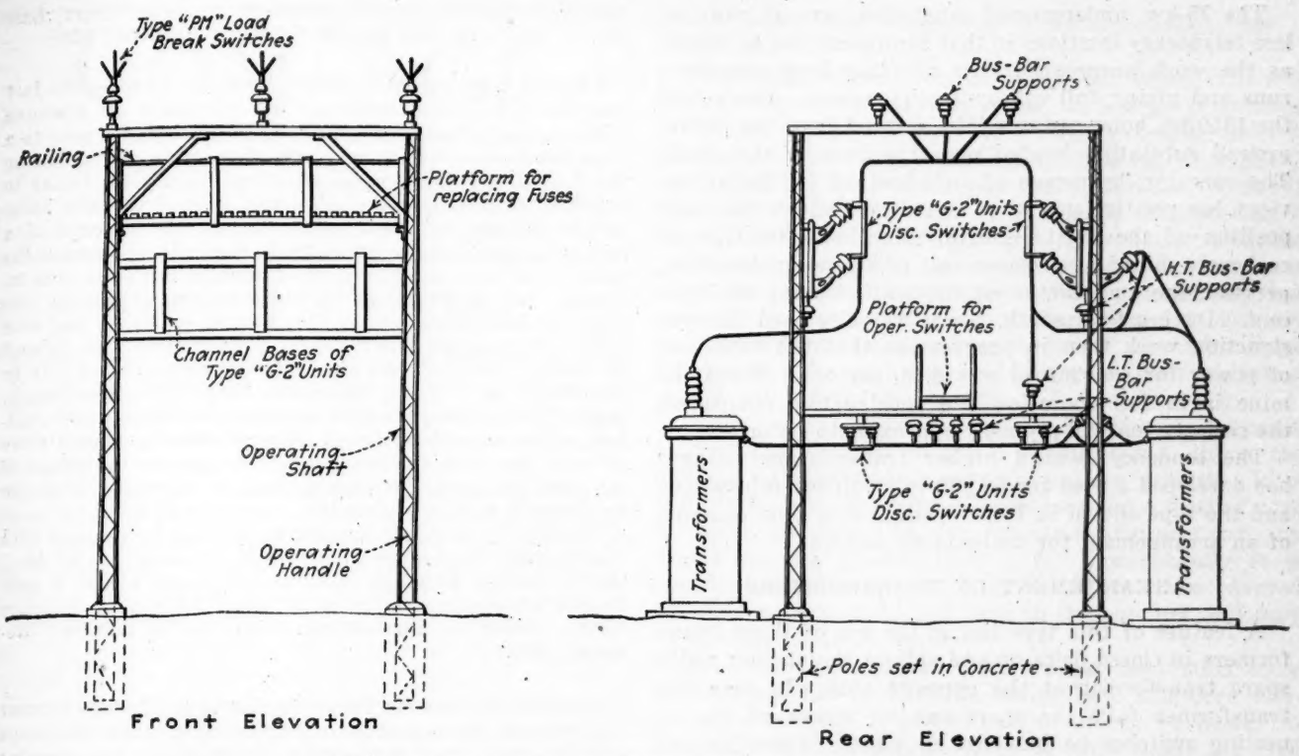

FIG. 8. TYPICAL COAL-MINE TRANSFORMER SUBSTATION

The underground cable from panel 2 terminates at a panel on which is mounted two automatic oil switches. The cable from one switch has a tap line to which is connected 20 underground substations, each station being equipped with three 25-kva. transformers and an oil switch. The feeder voltage of 2300 is transformed to 220 for use with alternating-current coal-cutting machines. On the same feeder cable is connected a 300-kw., 2300/220-volt motor-generator set supplying direct current for the main haulage trolley. This motor-generator set also supplies current to twelve stations for charging the storage-battery locomotives. The other switch and cable supplies power to a 100-kw., 2300/220-volt motor-generator set for the main haulage direct-current trolley and also connects to 20 underground substations for supplying current to the undercutters.

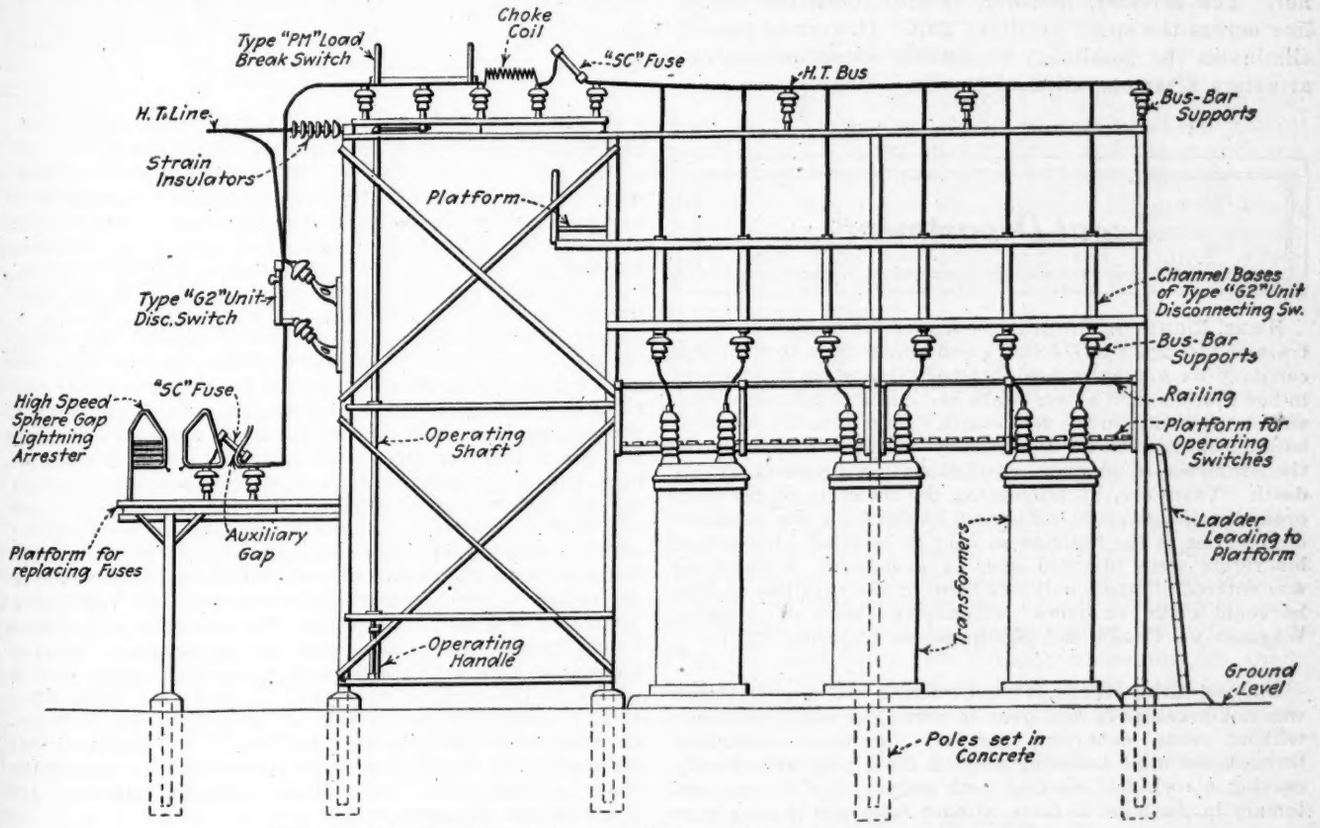

FIG. 9. ANOTHER TYPICAL COAL-MINE TRANSFORMER SUBSTATION

The 75-kw. underground substations are at more or less temporary locations so that equipment can be moved as the work progresses, thus avoiding long secondary runs and giving full voltage to the motors. Control of the 1350-hp. hoist motor will be secured from the underground substation located near the base of the shaft. The operator, by means of switches and indicating devices, has positive control of and always knows the exact position of the hoist. During March 25,000 tons of coal were mined at a power cost of approximately 6.5c. per ton, the load factor on the station being 41.5 per cent. During this month, power was also used for construction work then in progress so that the total cost of power for coal mined was 8.1c. per ton. When the mine is in full operation and construction completed, the cost per ton will probably approximate 4c. or less.

The tendency toward higher transmission voltages has developed a need for 66,000-volt outdoor substations and the type shown in Figs. 8 and 9 is a good example of an arrangement for coal-mining serivce.

ARRANGEMENT OF TRANSFORMERS

A feature of this type lies in the use of three transformers in closed delta on one side of the station and a spare transformer at the opposite side. In case one transformer fails the spare can by means of disconnecting switches be immediately placed in service and in the correct electrical relation to the other transformers.

The high tension side is controlled by means of a three pole air break switch operated from ground level. On the switch bases are also mounted choke coils and fuses for the load circuit.

The lighning arresters are of the high-speed, sphere-gap, graded-resistance type with auxiliary gaps shunted with limit fuses. In case of excessive flow of current to ground the limit fuses will operate in the usual manner. The arrester, however, is still connected to the line across the small auxiliary gap. This arrangement eliminates the possibility of entirely disconnecting the arresters after operation of the limit fuses.

Legal Department

HEIRS' RIGHTS TO ROYALTIES—A married woman owned a tract of coal lands in Kentucky and leased them to a mining company on a royalty basis. Operations were commenced in her lifetime, and at her death her husband became vested with a life estate in the real estate. Held, that the husband became entitled to all the royalty during his lifetime, to the exclusion of children entitled to the property at his death. Therefore, by purchasing the interests of the children, the lessee could not avoid liability for the payment of royalties to the husband so long as he lived. But where his rights were litigated and, by agreement, a judgment was entered allotting only one-third of the royalties to him, he could claim no more. (Kentucky Court of Appeals, Wagoner vs. Caudil, 212 Southwestern Reporter, 422.)

DRIVING MINE MULES WITHOUT REINS—A mine employee was not necessarily negligent in driving a mule in a mine without reins, debarring recovery for injury sustained through the mule knocking down a mine prop and thereby causing a rock fall injuring such employee, if it was customary in the mine to drive without reins and if none were furnished this employee. (Alabama Supreme Court, Barton vs. Brilliant Coal Co., 81 Southern Reporter, 828.)

PROVING NEGLIGENCE IN MINE ACCIDENT CASES—The fact that the state mine inspector had inspected an Alabama mine and made no objection to the proximity of a post to a tram track is not a circumstance disproving negligence on the part of the operator, as affecting liability for injury to a driver employed in the mine and injured through being caught betwen the post and a car, in the absence of a statute authorizing the inspector to prescribe or approve the location of such posts, and proof that he did so in this instance. Nor is the operator's freedom from negligence conclusively established by the fact that no employee had ever before, throughout many years of operation, been injured by contact with the post, although this circumstance may be considered as a strong indication of freedom from negligence. Persons experienced in mining operations are qualified to give expert testimony as to whether a miner's place of work has been rendered unduly dangerous by reason of too close proximity between a post and a track. When an employee is suddenly placed in a position of peril and must act quickly to extricate himself, he will not be charged with contributory negligence in hurriedly choosing a way leading to injury, although it afterwad appears that a safe avenue of escape was open to him. (Alabama Supreme Court, Taylor vs. Birmingham Fuel Co., 81 Southern Reporter, 630.)

FAILURE TO FURNISH PROPS AS CAUSE OF MINER'S INJURY—A miner's demand upon an employing operator for props and non-compliance therewith will not render the operator liable for injury to the miner unless the accident is fairly attributable to the nonsupply of props. But where the miner, after failure of the employer to comply with the request, mistakenly satisfies himself that he can proceed safely, with reasonable ground for such belief, he can still recover by showing that he would have used props had they been furnished as requested. The statutory duty of operators to furnish props, under the Arkansas law, falls within the statute of that state, providing that, where an employee sues for injury contributed to by the employer's violation of a safety statute, recovery shall not be defeated on the ground of assumption of risk by or contributory negligence of the employer. (Arkansas Supreme Court, Watts vs. Western Coal and Mining Co., 199 Southwestern Reporter, 921.)

DISREGARD OF ORDERS AS CONTRIBUTORY NEGLIGENCE—An explosion occurred in an Illinois mine one afternoon, but all of the mine employes, about 235, escaped injury, as they were on their way out of the mine, excepting two shotfirers, who were killed. An assistant mine manager returned with a miner to investigate the cause of the explosion, but finding bad air caused by the fact that the ventilating apparatus had been put out of commission by the explosion, they left the mine by way of the escapement shaft, leaving a plainly marked warning on a board across the entry, "Danger—Stay Back." In the meantime, one of the mine stockholders directed one Krummel to enter the mine and bring back the assistant mine manager and his companion. When these two men appeared on the surface, Krummel was reached by telephone in the mine and commanded to return, but he disregarded this order and proceeded to search for the unfortunate shotfirers. He was overcome by gas and died in the mine. In a suit brought by his administrator it was claimed that the coal company was liable for Krummel's death, because of violation of the Illinois Mining Act in ordering him to reënter the mine while the ventilating apparatus was out of operation, but the Illinois Supreme Court decided that there could be no recovery, because Krummel's own act in disregarding warnings given him to return to the surface intervened to cause his death after he had wrongfully been directed to enter the mine, although the operator would have been liable had it not appeared that decedent's life would have been spared had he obeyed the order to come out. (Randall vs. Crescent Coal Co., 117 Northeastern Reporter, 773.)

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Who is Chargeable for the Short Time?

THE public is quite ready to lay on the shoulders of the coal producer the blame for the short time in the coal industry, despite the fact that the idle time is entirely due to the irregular and seasonal demand of the public.

There are many seasonal industries. Some are necessarily seasonal as regards production, others in the matter of consumption and still others are seasonal as to both. The coal industry is of the second class in seasonal in the matter of consumption. It can produce as well in the summer as in the winter if the public will only buy, but it doesn't. Hence the industry becomes seasonal because of the action of the public.

The cereal-growing and tobacco-raising industries are of the first class in seasonal in the matter of production. Production in the farming industry is confined to a few months of the year, and consumption is distributed the year over. The natural-ice industry, of course, illustrates the third class, for maximum consumption and maximum production are found at the extremes of the calendar, and the seasonal character of the industry is so marked that no one realizes what hardships it entails. The men who are engaged in it are obliged to make all the arrangements involved in transferring their labor from one industry to another as soon as the season changes. Whereas in the coal industry, the necessity for a transfer is less severe, the wrong only appears greater. The workingman tries his hardest to make ready what is in its nature seasonal, and the operator also uses his utmost endeavor to the same end.

The relatively small quantities to be handled and the short period during which the storage of coal is advantageous, make the overhead charge for the machinery for handling coal around a manufacturing plant quite large. One is not always surprised that corporations hesitate to put in large storage plants under the difficulties which confront the making of such provisions.

Then again, the extremely small consumer, who is usually merely a tenant at will, hesitates to load up his cellar when he does not know how long he is going to stay in the house. With rents continually rising and properties fast changing hands, no householder is disposed to lay in coal for fear that he may be compelled to move.

On the other hand the mining industry has many reasons for not storing coal. It costs some money to make the requisite storage provision, though the cost is not so much in proportion to the amount of coal stored as it is to the industry which is storing coal simply for its own use.

Another reason for not storing coal at the mines is that it involves two handlings, which the coal would not otherwise have to undergo, and the outcome of every handling and of every month of storage is degradation of size. To this must be added the cost of such storage and the slight loss in heating value, the latter being so small that it would, in general, be entirely overlooked except where coal is sold by exact calorimetric determinations.

Then again, there is the difficulty that stored coal will freeze in the winter and may take on a large percentage of ice and water. But all these causes together do not seem as vital as the possibility of slow or rapid combustion of the fuel in the pile and the certainty that if there were a large amount of storage in the summer, it would be impossible to get cars to transfer it to the points of consumption during the winter. In fact, it is often the case that in the winter there are not only not enough cars for the running of the mines, but certainly no cars for the hauling of stored coal. Moreover there are many points which are embargoed during certain periods of the winter months.

In the Central States storage for larger amounts could be provided without so much difficulty, but, there, the dangers of spontaneous combustion are greater. It is not uncommon for an operator to take out a quarter acre of coal a day, and it is often unsafe to pile that coal any deeper on the ground than 5 ft. Consequently it is readily seen that a large area would soon be covered where a mine worked full time in the summer and only shipped out half its product.

The difficulties of the public have been sufficiently enumerated, but perhaps its duties have not been adequately stressed. It is the custom of the purchaser in industries like farming to carry in many cases the load of the producer. Very few farmers carry their wheat for any length of time. In like manner it would seem that the public should endeavor to provide in every possible way to purchase coal early in the year. If it cannot do that with advantage, it does ill to complain of the miner receiving only short time. It is not just for those who will not buy coal in the summer to condemn the operator for not meeting all the many difficulties described in order to assist his employee, because in the long run the purchaser is the real employer of labor and should feel his responsibility as such.

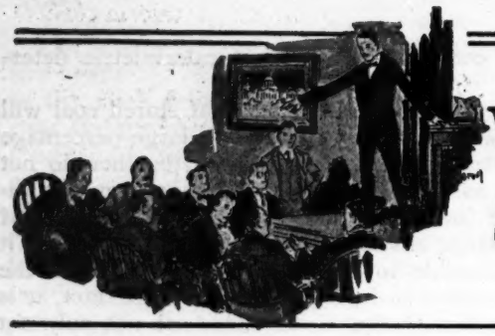
Statistics of Destruction

From survey data collected in the Pittsburgh district, over $25,000,000 worth of time has been lost by men on strike in the steel mills at that place since the strike order went into effect on September 22. The number of workers in the district is 228,430 of which 109,455 have already returned to work. Seven persons have been killed in riots and 173 injured. Over $150,000 worth of damage has been done as a direct result of the strike.

Surely may one pause in reviewing the results of the strike, and ask, "What has it profited?" Not only from the standpoint of production, has the country suffered but the number of people dependent upon charity has materially increased. The strike in its entirety has been a failure and was a failure from the day of its origin.

During the war, the casuality lists were perused daily with the greatest concern. Everything possible was done on this side of the water to prove to the boys in France that the country was behind them to a unit. Those who have their final resting place in the fields of Flanders died with the thought uppermost in their minds that America as they knew it was well worth the privilege of fighting for, even though that duty included death itself.

Is unionized labor keeping faith with those who sleep on the other side when the balance sheets show returns such as those that come from Pittsburgh?



WHAT THE ENGINEERING SOCIETIES ARE DOING

A National Department of Public Works Versus the Corps of Engineers, U. S. A.

BY ISHAM RANDOLPH

The United States Engineer Corps is a body of men justly proud of its record, but hostile to any movement which threatens its authority or reduces its field of action. It has on its roster the names of many men who deserve credit for high attainments. Their country had educated them and made them a class apart, invested with authority and clothed with dignity. They have been entrusted with vast responsibilities and for the most part have discharged those responsibilities worthily, but not without the advice and help of untitled civilian engineers, who have paid for their education and got their experience without the aid of a paternal Government. It is these men who have done the vast proportion of the work for which men who wear insignia of military rank have been accorded, and have graciously accepted, the credit.

A statement of the vast area of the field of operation of the Corps of Engineers is a fitting preface to what I am about to say. Continental United States has an area of 3,742,583 square miles, within which are 26,410 miles of navigable rivers, 1,200,000 square miles of arid lands and 75,000 square miles of swamp lands. Our continental and insular coast line is 48,881 miles long, not including our water front on the Great Lakes. We have between 35 and 40 continental ports, besides all those in our insular possessions. There are 517 West Point engineers to care for this vast array of work, as shown by the "Statement showing rank, duties, and addresses of the officers of the Corps of Engineers," issued by the War Department Jan. 1, 1919. They are divided as follows:

	Active	Retired
Major General	1	2
Brigadier Generals	..	2
Colonels	23	6
Lieutenant Colonels	30	3
Majors	74	..
Captains	151	1
First Lieutenants	148	..
Second Lieutenants	76	..

A large proportion of these captains and lieutenants were rushed through West Point without completing the course of study. We have then, old and young, experienced and novices, 517 officers to do the vast work suggested by the citations previously made. There are in the United States over 100,000 engineers in the various lines coming within the term Engineering. Thousands of these men responded to War's compelling need; the American Society of Engineers supplied more than 1500. The Western Society of Engineers 148. The American Society of Mechanical Engineers sent 1497. The American Institute of Mining Engineers 739. The American Society of Electrical Engineers supplied 1412. The American Society for Testing Materials supplied 575. The architects sent hundreds. These were not novices, but men who, when the need was presented, were able to meet it, and their record of achievement is a proud one. They know that they have earned recognition from the Government. They are so self-respecting that they are not willing, now that the piping days of peace have returned, to do the planning and the work which must be done along their several lines, and submit their work to a military engineer who, as a matter of form, will attach his name to the plans and as a matter of course accept the credit which goes with the work.

Military engineers are educated to meet the constructive and destructive needs of war, and war has demonstrated to the United States its need for them. They do not fit into the everyday life of a democracy. Their training makes them autocratic. Most of them have the instincts of gentlemen and they deport themselves as such, but the officer is a rare exception who can wholly divest himself of a superior attitude toward the civilian. The feeling may be successfully camouflaged, but it is only in concealment.

CIVILIAN ENGINEERS AID IN MILITARY WORK

We think that no record will disclose a structure designed for the uses of peace and erected under military direction which has been designed, supervised and completed wholly by the military engineer without aid or counsel from some civilian engineer. In support of this statement the Sault Ste. Marie locks and the Panama Canal are in evidence. Are not the skill and brains of Alfred Noble, Joseph Ripley, L. C. Sabin, David Molitor, Isaac De Young and many other civilians built into the Sault structure? Then take the Panama Canal. It is to the glory of the Corps of Engineers, U. S. A., that they were in charge of that tremendous project, and the names of Goethals, Sibert, the beloved Gaillard and Hodges will always flash upon the screen of memory when that work is thought of, and *they* have had recognition and reward; but we, who know, will also remember Williamson, Goldmark, Schildhaur, Cornish, Zinn, Nichols and their civil associates. Alfred Noble, too, left his impress upon that great work. The Pacific Division had as its chief, S. B. Williamson, civilian, all of whose aids were civilian engineers.

An examination of the chief engineer's report for 1913 (Vol. 6, Statement of Construction Expenditures to June 30, 1913) shows that the military on the Atlantic Division built 2,265,415 cu.yd. of masonry for $16,993,254.33, or an average of $7.50111 per cubic yard; and that the civilians on the Pacific Division built 2,453,320 cu.yd. for $13,646,113.96, or an average

of $5.5627 per cubic yard; showing a civil economy of $1.9384 per cubic yard over the cost of the Military Division, or a saving of $4,745,515.49 on the job. Did Williamson ever receive any recognition from Congress? He did receive it from a business organization to which his achievement recommended him. Did any one of his civil associates receive commendation or reward from Congress? If so, when, and what was it?

And furthermore, we know that these engineer officers did not plan the Panama Canal. The type and salient features of the canal were worked out by a minority of the International Commission for the Isthmaian Canal. To the project thus prepared the army engineers fell heir—a project changed, except as to dimensions, in only one particular. The lake which the minority planned on the Panama side of the Culebra Cut, with dam across the Rio Grande and locks between Sosa and Ancon, was abandoned because locks in that location would be within range of gunfire from warships. The locks were moved back to Miraflores and a large item of cost was added to the work. The wisdom of this move from the military standpoint could not be questioned then, but the World War has shown such advance in the power of modern artillery and indirect fire has reached such precision of aim that the interposition of a hill and the withdrawal for a few miles counts for but little as a means of defense.

I have grown old in engineering service and I have been in touch with military engineers for forty odd years. I have admired, valued and still value the friendship of many of them. But I have not learned to admire the system which environs them, and I believe that the injection of that system into the activities of our civil life is a harm so great that it needs to be abated, as it will be by the passage of the bills introduced June 25, in Senate by Hon. Wesley L. Jones, and House by Hon. Frank G. Reavis, and the 100,000 or more engineers of our country should use every honorable influence and means to secure that legislation.

Coke and Its Byproducts

The manufacture of coke has always been considered a basic industry, but the immense value of coke and its byproducts was not generally realized in this country until we entered the world war, when our byproduct coke ovens were called on to supply the raw material required for making dyes and explosives. These ovens also supplied most of the ammonia used for refrigerating meats and other perishable articles sent abroad, as well as the larger part of the coal-tar products used in building roads and cantonments and in other military construction, besides furnishing artificial gas for illumination and for heating and oils for the flotation of ore. The direct product of these ovens—the coke itself—is required for use not only in metallurgy and other manufactures but for domestic heating and cooking.

By the fall of 1915 it had become evident that the war must be won not only by the mobilization of armies but by the mobilization of industries—that it would be won by the nation that could produce steel, other metals and explosives in greatest quantities, and as coke is essential to steel making and its byproducts are essential to the manufacture of explosives the coke-making industry at once came to the front and became a center of intense interest. The foreign demand for munitions had become so great at the beginning of 1916 that the quantity of coke produced made a new record, but during the fall of that year the output was considerably restrained by the congestion of traffic on the railroads. The difficulties that had to be overcome in producing and marketing fuels after the United States entered the war and the means adopted to overcome them have now become matters of history.

Though the output of coke in 1916 had exceeded that in 1915 by 31 per cent., reaching 54,000,000 tons, the output in 1917 went still higher, amounting to more than 55,000,000 tons, valued at the ovens at $298,000,000. More than half of this coke was made in Pennsylvania, and more than half the remainder was made in Alabama, Ohio, Indiana, West Virginia and Illinois.

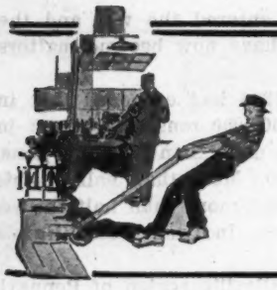
The prices of coke in the Connellsville region of Pennsylvania, the most active coke market in the United States, reached top figures in 1916 and went higher in 1917, the price of spot furnace coke reaching $16 a ton in July and that of spot foundry coke reaching $14. A Presidential order of Sept. 24 established a price of $6 a net ton for both grades.

The United States Geological Survey, Department of the Interior, has just published an advance chapter of its volume "Mineral Resources of the United States," entitled Coke and Byproducts in 1916 and 1917, by C. E. Lesher and W. T. Thom, Jr., which contains a review of the coke industry in the United States during those years, statistics of production, distribution and consumption, and other information concerning the coke-making industry. A free copy of the pamphlet can be obtained from the Director of the Geological Survey at Washington, D. C.

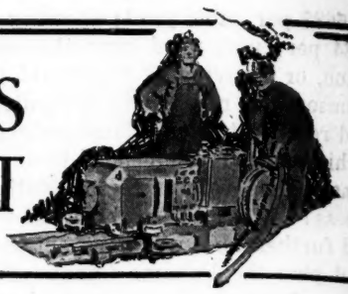
The rescue crews at a mine disaster work in close coöperation with the recovery crews and make explorations in advance of the ventilation for purpose of finding live men, locating bodies, testing the mine air and looking for fire. In the conduct of the work the members of the recovery crews should not allow themselves to get ahead of the air, so that they breathe the afterdamp, as it will have a bad effect on them and reduce their efficiency. Especially should the foremen of the recovery crew guard against unnecessary breathing of the afterdamp in order to prevent their usefulness and judgment in directing the crews being impaired and the work delayed. The rescue crews should act in accordance with their previous training and instruction, at all times having regard for their own personal safety. Common sense and good judgment coupled with experience at mine disasters are prerequisites for the efficient conduct of rescue operations.—*Rescue and Recovery Operations in Mines.*

On account of the complex nature of tar a great many reactions are involved in its decomposition. In general, the cracking is similar to that of hydrocarbon gases, but many more compounds are involved and the result is a very complicated equilibrium among a large number of hydrocarbons. Very little experimental data are available on equilibrium and the velocity of these reactions; however, the high temperature in the furnace and the fact that the tar is in a state of fine subdivision favor rapid cracking and the formation of large amounts of carbon.—*Bureau of Mines Bulletin No. 135.*

The United States has under contract or construction 819 shipbuilding ways, which is twice as many as there were in all the other shipyards of the world before the war began.



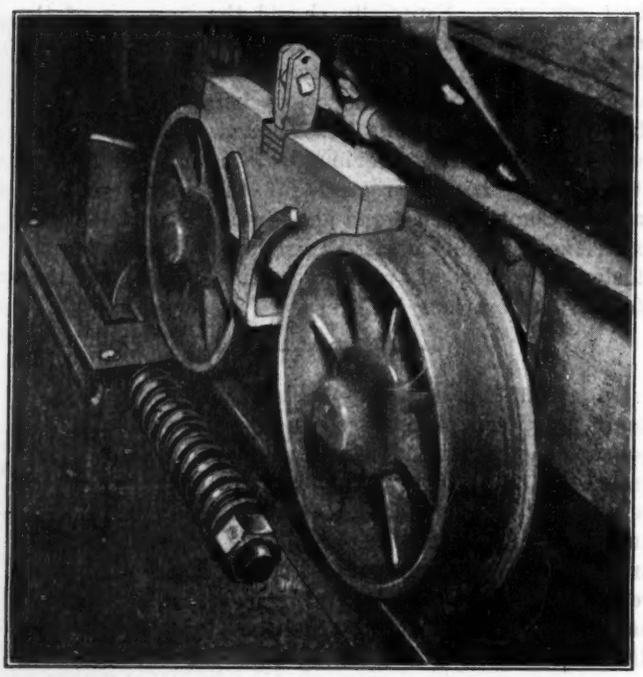
NEW APPARATUS AND EQUIPMENT



New Type of Safety Horn

What is termed an oscillating, cushioned, non-adhering safety horn has been patented by G. M. Johnson, of the G. M. J. Manufacturing Co., of Pittsburgh, Penn. The device presents many interesting features of design and construction that make its operation different from other similar devices. It is intended for use at top, intermediate and bottom landings of shaft mines, on mine slopes and grades, elevations near tipples and on inclines where chain or rope haulage is used.

A wing-shaped steel horn is arranged in a bearing plate having an elongated slot. A 2-in. shaft is inserted in the bearing plate passing through the horn and being bolted to it. A longitudinal movement of 2 in. is given the horn in the slot by its being longer by that much than the horn collar. A compression spring is fitted upon the protruding end of the shaft and against the bearing plate. This permits the horn and shaft to move longitudinally in the bearing plate when pressure is brought to bear on the face of the horn by the backward movement of a car. The tension of the spring is made adjustable by tightening or loosening a nut on the end of the shaft against the spring.



VIEW OF HORN IN UPRIGHT POSITION

A recoil spring located in the bearing plate holds the horn in a vertical position and pulls it back into place after the wheel of an entering car has given it a lateral movement. The side of the horn lying toward the tension spring is curved, but this is not apparent in the illustration. The point of curvature starts above the inner bolts on the bearing plate, whence a slight bend is made away from the tension spring. This design allows for a firm hold on a wheel on which the tread has been somewhat worn, as is often the case with cars that have been used for any length of time.

In operation, the front wheels of an entering car push against the curved faces of the horn, forcing them outward. As soon as the wheels are beyond the horns these are returned to their vertical positions by the recoil springs. The same operation, of course, occurs for the rear wheels. The car may then be said to be in position with the rear wheels lying against the inner sides of the horns and the tread practically flush with the top of the bearing plate.

New Stucco Applying Machine

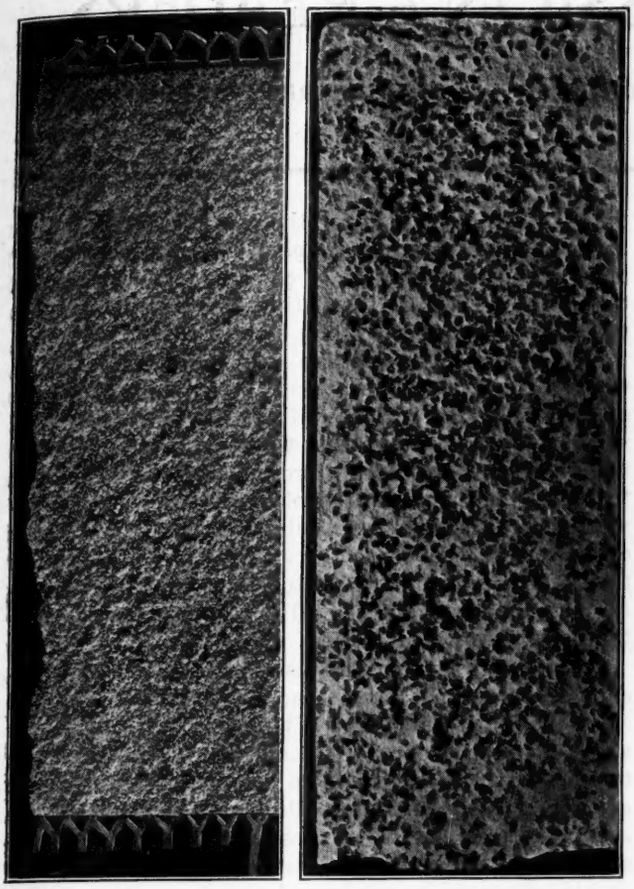
The Hodges Stucco Machine Works of Cincinnati, Ohio, has recently placed upon the market what is known as the Hodges electric stucco machine. This device consists of an electrically driven fan or impeller wheel, which receives mixed stucco from a feed hopper and projects it with considerable force against the surface to be coated. The entire machine weighs only about 30 lb., and in use is slung over the operator's shoulder exactly as a musician carries a drum. A spring in the support however enables the operator to easily change the elevation of the machine through small distances to suit the requirements of the work in hand.

The feed hopper and casing of the machine, and in general all parts except the driving motor and those members requiring great strength, are built of aluminum. The shafts are supported either in Swedish ball bearings or in bronze sleeves. All gears are of cut steel and run in grease. The motor is of the universal type—that is, one that will operate upon either direct or alternating current. The machines may be wound for either approximately 110 or 220 volts, but one and the same machine will not operate upon both of these voltages.

This machine is particularly useful in applying stucco to either new or old frame buildings, putting a protective coat upon brick or stone walls or buildings, coating brattices with cement and thus rendering them air-tight, waterproofing the surface of dams or reservoir walls, and similar operations requiring a dense covering of stucco or cement. In such work filling and finishing coats, also pebble-dash coats, may be applied with equal ease. If smooth surfaces are desired, the rough coats given by the machine may be troweled as in ordinary practice. From 300 to 450 sq.ft. of surface should be covered per hour with stucco from ¼ to ⅜ in. thick with one of these machines.

The small size and easy portability of this machine adapt it admirably for use underground. Here it will find a place in erecting or repairing brattices, rendering overcasts or undercasts air-tight, as well as in seal-

ing off incipient mine fires. Particularly in the last-named operation are its lightness and rapidity of action strong considerations in its favor.



SECTIONS OF STUCCO TREATED SURFACES

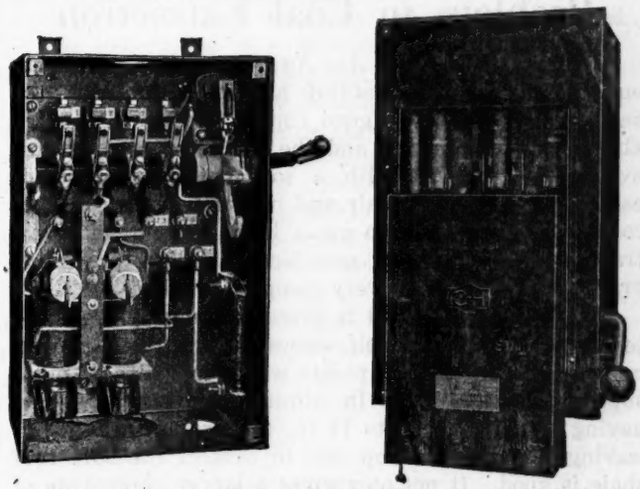
The number of men required to run one of these machines is usually three—the operator, who directs and controls the machine; the helper, who feeds the stucco to the machine hopper; and the mixer, who prepares the stucco.

Motor Starters with Protection Features

Many collieries and mines are installing fully inclosed motor starters in locations where exposure of operating parts is undesirable. The inclosed starter is not only an insurance against injury to workmen, but also protects the working parts from outside mechanical injury such as might be caused by flying particles of coal or other material, or through leaning an object against it. Two new motor starters manufactured and recently placed on the market by The Cutler-Hammer Manufacturing Co., of Milwaukee, Wis., have their parts fully inclosed and are easy of installation and simple in operation.

All live parts of these switches are completely incased. They may be readily inspected, however, by lowering a sliding panel. This opens the switch, and the starter cannot be operated until the panel is again in the closed position. All danger from live parts is thereby eliminated. The most unskilled person can manipulate either type, operation merely requiring a short radial movement of a lever projecting from the side of the inclosing case. The handles may be locked to prevent unauthorized operation. The contact posts and fingers are of standard C-H drum construction, easily inspected and renewed, while their vertical position prevents the accumulation of dirt and grease. The cases are arranged for conduit wiring.

A duplex overload relay and low-voltage release coil are provided with one of the starters. These are both inclosed with the switch. The overload unit has an inverse time element which permits a large initial starting current or a temporary overload, but protects the motor from a continuous heavy input. The switch is made with either three or four poles.



OPEN AND CLOSED VIEWS OF THE STARTERS SHOWING GENERAL ARRANGEMENT

The other starter, which is fused, is especially adapted for those motors that cannot be connected directly to the line when starting. A resistor, inclosed in the same casing with the switch, decreases the initial voltage to 60 or 75 per cent. as desired, and maintains the balance of all three phases while starting. The fuses are out of the motor circuit until the rotor has reached normal sped; therefore they do not carry the heavy starting current and need be of no greater capacity than proper protection requires. This starter contains a low-voltage release coil. Both starters are made in various capacities for operating squirrel-cage motors on potentials not exceeding 550 volts.

Temperature and heat are not synonymous. Temperature is shown in the arbitrary divisions of the thermometer; the Fahrenheit scale has 212 deg. between zero and the boiling point of water. The zero point is 32 deg. below the freezing point of water. On the other hand, heat is a measurable quantity—it is measured by the thermometer. As a unit—*e.g.*, the British thermal unit (B.t.u.)—it is the amount of heat necessary to raise one pound of distilled water 1 deg. F.

A mixture has been worked out in which 10 bags of cement and 23 bags of crushed granite screenings are used in the making of grindstones. *Concrete* states that the stones are cast in a three-piece cast-iron mold and that no reinforcing is used. The stones are cured six months before they are used. The grinders are made in two styles—those for edge grinding are 60-in. in diameter and those for side grinding are 16-in. thick. It is understood that the idea is patented.

DISCUSSION *by* READERS

EDITED BY JAMES T. BEARD

Problem in Coal Extraction

Letter No. 6—In *Coal Age* Aug. 7, p. 234, a writer has outlined a method of mining a thick bituminous coal seam lying at a fairly good depth. Owing to the friable nature of the coal and the thickness of seam and overburden, coupled with a soft bottom that yields easily to the action of air and moisture, and bad labor conditions, the desire to get a large percentage of extraction with the least possible change in prevailing practices makes this a very complex problem.

The depth of the coal is given as ranging from 450 to 600 ft. This in itself shows that generous pillars must be provided at all points where long life of pillar support is necessary. In mining this seam of coal, having a height of 8½ to 11 ft., the present practice of leaving up 1½ ft. of top coal to protect the soft roof shale is good. It not only gives a larger percentage of extraction by affording a good roof support, but prevents many accidents from roof falls and conserves the mine timber.

THE PANEL SYSTEM IS ADVANTAGEOUS

The panel system with its numerous modifications, so prevalent in the Illinois fields, offers numerous advantages, affording as it does separate air splits for each section of the mine, whereby the gas is carried into the return by the shortest route, localizing explosions of gas or dust, localizing squeezes or creeps, and making it easier to handle a mine fire in case of necessity.

From the plan presented, it appears that the rooms are not holed through from one panel to another. This greatly assists in localizing the air current, fires and explosions. In some sections of the country the coal so left is called a "firewall." This coal, varying from 10 ft. to 25 ft. in thickness, is lost, or at least no attempt is made toward its recovery.

From the description of the methods of attacking the panels, I would suggest forming the main divisions in blocks of about 1,500 ft., and driving triple entries instead of the double entries shown in the figure. A barrier pillar of 100 ft. should be left to protect each entry. Driving triple entries will permit greater quantities of air to be circulated at a lower velocity and reduce the cost of ventilating by the double-entry system, providing the sectional areas of all entries are the same.

I wish, especially, to call attention here to the condition that will result from this double-entry system wherever large locomotive trips are hauled on each entry, the empty trips going in on one entry, while the loaded trips are hauled out on the other. For instance, in the mine shown, the clear height on the roads will vary from 5½ to 8 ft., the width being 12 ft. Hauling trips of 50 loaded cars, each car approximating an overall length of 10 ft., would make a plug about 500 ft. long inserted in the airway. Now, if we stop to figure the available space left for the passage of air and the increase in velocity and rubbing surface where the air must rush past this train of cars, we will soon see that the increased cost of ventilating power will more than pay the extra cost of driving a third entry.

Driving the room entries 520 ft. apart as shown, would seem to be good practice, judging from the results of experience in regions with similar conditions. I would suggest, however, that the room entries be driven up to the boundary of the firewall, and the rooms then turned off on the retreating plan. Also, I would recommend that the two room-entries driven toward each other be attacked about the same time, both reaching the 25-ft. barrier or firewall together, when the retreating plan of attacking the coal can be commenced simultaneously on all the entries.

The mining law, in Illinois, requires that all crosscuts be driven not more than 60 ft. apart. I would drive the rooms on about 70-ft. centers, with roomnecks about 12 ft. wide for 25 ft., and then widen out square to a width of 18 ft., so as to prevent further yardage expense. This would allow about a 60-ft. pillar. While keeping within the law of crosscut or breakthrough requirements, the method of cutting through the pillars should, of course, be governed by local conditions, which must determine whether the crosscuts should be 12 ft. with yardage expense, or 18 ft. wide without yardage, in each individual mine.

This system of leaving the largest percentage of coal in the pillars, for later recovery, has been and is now successfully carried on in the Fairmont, West Virginia, region, where the geological conditions are very similar to the conditions described in the article to which I have referred. Where the work is done on the retreating plan there is never any need to return over the extracted portion. Therefore, rails, props and all other materials are brought back as the extraction progresses.

WHY THE RETREAT METHOD IS PREFERRED

I take it that the term "squeeze" as used in this article has not the same meaning as in Pennsylvania or West Virginia regions, but refers to the closing in of the space after extraction. In the states just mentioned, mining men understand a squeeze to mean a settlement or closing in before extraction or after a partial extraction. I take it, also, that the action described by this term is desirable in the Illinois fields, but that the subsidence of the surface is not desirable, owing to the value of the land's surface overlying the coal, and it is the preservation of the surface that makes it the local practice to recover only from 40 to 50 per cent. of the seam.

From a financial standpoint, this problem resolves itself into a simple question of which is the most valuable, the surface land or the loss of 50 per cent. of the mineral? If the surface is the most valuable, then this loss of 50 per cent. of the coal is not rightfully

chargeable to the present or local mining conditions or practice. I fear a very large number of mining men and students of mining become astounded at the assertion of a 50 per cent. recovery, before ascertaining all the reasons for such a practice. Later, they express the opinion that mining methods employed where such a recovery is obtained are surely defective, which may not always be the case.

I see no difference in respect to the detailed analysis given of labor conditions, methods of lighting the mines, the working of a certain number of men after one machine, the undesirability of changing present methods, the delivery of powder and mine cars to the men, the laying of the tracks, the cosmopolitan makeup of the employees and the duties and work of the shotfirers, between the region described in this article and most other regions where coal mining is carried on extensively.

R. Z. VIRGIN,
Assistant Professor Coal Mining,
Carnegie Institute of Technology.

Pittsburgh, Penn.

Lawful Examination of a Mine

Letter No. 7—My previous experience as a fireboss has interested me deeply in the discussion relating to the lawful examination of a mine. I understand this term to refer to an examination that complies in every respect with the state mining laws.

It will not be denied by those familiar with the operation of coal mines that, while the mining laws in some states are too stringent in many respects, there are instances where the simple fulfillment of the requirements of the law, on the part of the fireboss or mine examiner, will not give the operator a just return for the expense he is under to have the mine examined.

For that reason, an honest fireboss who performs his work conscientiously will frequently feel called upon to do more than what is required in the law. Not only will he examine the working places for gas, but he will not be satisfied without looking for other dangers that may be present and make the place unsafe for work. The performance of this extra work will frequently require more time than what is generally allotted for the examination.

Right here, I want to emphasize what has already been said by others, that firebosses quite generally have too much territory under their supervision to enable them to give the highest efficiency in respect to economy and safety. Also, I want to endorse the statement that the examination of a mine should not be begun more than three hours before the men go to work in the mine. This is particularly necessary where there is any liability for gas to accumulate in the working places. The same is true where booster fans are used to assist the circulation of air in certain sections of the mine. The steady operation of a booster fan is very uncertain, requiring that such a fan be constantly watched to make certain that it is kept running. It is quite clear that, should a booster fan cease running a short time after the fireboss has made his rounds, there would quickly result a very dangerous condition in that section of the mine.

In order to overcome these difficulties, let me suggest that firebosses should be given less territory to look after, which would allow them to perform the work of a roomboss or safety examiner. After making out his report as to the condition of the section of mine in his charge, the fireboss should enter the mine with his men and continue to look after their safety, acting either as an assistant foreman (roomboss), or a safety mine examiner. This would give him an opportunity of more faithfully performing the work for which he is held responsible.

W. H. LUXTON.

Linton, Ind.

Letter No. 8—It is not surprising that this subject would create much discussion among mining men, especially those who are employed as firebosses or mine examiners. One of the chief requisites of a lawful examination is that it shall be entrusted to a sober, reliable man who is competent to perform the work, conscientious in the discharge of his duties and awake to his responsibilities.

A reliable fireboss will not omit to examine every working place in his section, whether or not he has found gas there on previous occasions. He will not, as is sometimes the case, content himself with thinking that a place contains no gas because none has ever been found there before. Conditions in mining are constantly changing, and in gaseous mines dangerous atmospheres often exist where least expected.

It is important that the fireboss should realize to what extent the miner depends on his work. When entering his place in the morning and finding the mark the fireboss made there a short time previous, the miner assumes that all is well and begins work without making a further examination on his own account. In other words, he trusts his safety to the honesty and judgment of the fireboss, which makes the latter, in a large measure, his "brother's keeper."

Not only should each working place be examined for gas and the condition of the ventilation carefully noted, but the fireboss must look for bad top or loose overhanging coal and observe the amount and kind of timber on hand and any undue accumulations of fine coal and dust that would make the place unsafe for work.

GAS MAY BE PRESENT

Nor is the examination of a mine completed when all these things that I have mentioned have been done. A careful watch must be kept over old abandoned workings, and any accumulation of gas that might be dangerous to the workmen must be prevented as far as practicable. Where such an accumulation of gas is found it must be carefully removed and steps taken to prevent the same occurring again. When this is not practicable, the workings must be sealed off with substantial air-tight stoppings.

It often happens that, while a good fireboss realizes his duties and responsibilities, the section of the mine in his charge is not so large that he cannot make the necessary examination in the time allotted him. He must hurry along, having barely time to look for gas in those places where he has reason to believe danger may exist. He is compelled to take chances and give the most careful attention to those places where he has found gas before. Our West Virginia mining law requires the examination of a mine to begin within three hours of the time for men to begin work; but many sections of these mines require much more than three hours for a man to make a thorough and proper examination of each place.

Mention is made, in a letter by a Pennsylvania fireboss, COAL AGE, Sept. 18, p. 503, of the employment of two firebosses, which appeals to me as being a great advantage. It is my belief that the examination of a mine is not finished until the day's work is completed.

An incident that occurred only a short time ago will serve to illustrate my point. The nightshift in a certain mine, assuming that everything was in a safe condition, went to their work with perhaps less caution than should have been used. It so happened that, on this particular occasion, the nightboss was busy in another part of the mine. The machinemen leaving their machines, in violation of the law entered a working place that had not been examined for that shift, with the result that gas was ignited by their lamps and the men lost their lives. A night fireboss on duty would have prevented this accident, and the same can be said in many other like instances.

FIREBOSS.

————, W. Va.

INQUIRIES OF GENERAL INTEREST

ANSWERED BY JAMES T. BEARD

Design of Ventilating Fan

I am sending to COAL AGE a rough sketch showing an elevation of a mine fan and want to ask for information on one or two points. This is an exhaust fan having a diameter of about 20 ft. and an expanding casing that terminates in a funnel or chimney.

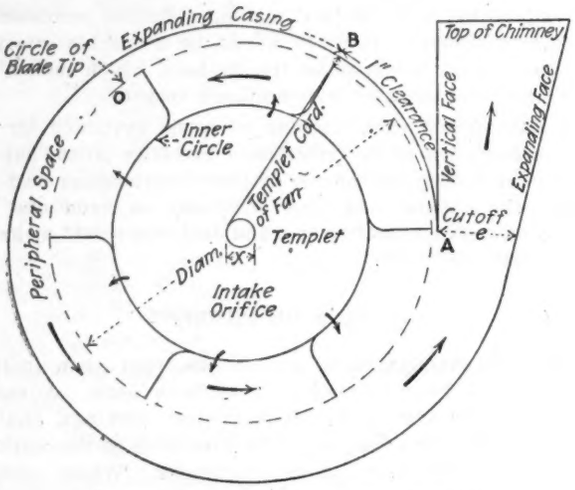


DIAGRAM OF VENTILATING FAN

First, I want to ask, should the cutoff be located at A or, as I am told, at B further back on the casing? Second, is the exhaust funnel or chimney necessary, and why? I hope that this question will be answered fully and that readers will give their experience.

Savanna, Okla. I. N. K.

In the operation of a centrifugal mine-ventilator, whether exhausting or blowing, the air enters at the center or intake orifice of the fan and, as indicated by the arrows in the accompanying figure, passes outward between the blades, until it reaches the circumference of the circle described by the blade tips, where it is deflected and passes around the circumference in the direction in which the blades are revolving. It is important that the fanwheel shall be set in such a position in the casing that the air flowing outward between the blades will be forced to travel around the circumference of the fan in the direction the wheel is turning. Otherwise, the movement of the blades will oppose the flow of air about the circumference. It is also important that the peripheral space between the blade tips and the casing expand uniformly in volume so as to provide a constant velocity of the air flowing through this space. Also, the fan must be so proportioned that the velocity of the air shall slightly exceed that of the blade tips, in order to prevent the eddying, which would result if the air traveled slower than the tips of the blades.

Again, in order to accomplish a constantly uniform flow of air about the fan in the direction in which the blades revolve, it is further necessary to so arrange the casing as to practically close one end of the peripheral space and shut off the flow of air for a distance AB, equal to the distance between two consecutive blade tips. As shown in the figure, therefore, this portion of the casing is made a circle concentric with the fanwheel and leaving a clearance of 1 inch between the tips of the blades and the casing. The point A is termed the "cutoff," and the expansion of the spiral casing begins at the point B.

The proper proportionment of a centrifugal fan is a difficult problem. The dimensions of the fanwheel, the inner and outer diameters, width of blades and the expansion of the casing at the cutoff, as indicated by e in the figure, depends on a number of factors, but chiefly the volume of air to be circulated and the unit pressure or water gage that will result from forcing this volume of air through a given airway or mine.

MINE POTENTIAL IS IMPORTANT FACTOR

Every airway or mine has a certain resisting power opposed to the circulation of air and determined by the cube root of the ratio of the square of the quantity to the unit pressure. This resisting power is called the "mine potential" and enters into the calculation of the proper dimensions of a fan designed to give the required circulation of air, under a specified unit pressure or water gage.

The question is too large a one to admit of its full explanation here. It can be stated, however, that the line of the expanding casing can be laid out, in practice, by describing a curve starting from B in the figure and using as a radius a chord that unwinds from a circular templet fixed at the center of the fanwheel. The diameter of this templet should be three-eighths of the total expansion desired at the cutoff. Thus, in the figure, x equals ⅜ e.

The expanding chimney is an essential feature of every exhaust fan, and is required in order to reduce the velocity of the air discharged into the atmosphere and save power.

Automatic Starter for Booster Fan

In seeking a little information, I turn to *Coal Age*. In one section of our mine we are operating an electrically driven booster fan. In this connection, some discussion has arisen as to the best means of overcoming the difficulty presented by the motor failing to start itself after being stopped by reason of a brief interruption of the current, which is liable to occur at almost any time in the operation of a mine.

In order to avoid the necessity of sending a man to start the motor again at such a time, it was suggested to equip the machine with a self-starter. Objection was offered to this plan, however, on the ground that the disadvantages of the scheme would outweigh the advantage gained by installing the device.

While I have no great desire for the use of boosters, I believe that when the necessity arises for their installation in a mine, they should be kept running as constantly as the main fan. Otherwise, it is my opinion that they are dangerous and should never be installed in a mine. I am interested particularly in knowing what are the disadvantages of an automatic starter on a motor operating a booster fan. W. H. LUXTON.

Linton, Ind.

In a properly arranged system of ventilation, and where proper precautions are taken to insure safety and aveid accidents resulting from a possible cessation or derangement of the circulation in the section of the mine where the booster is installed, there should be no disadvantage worthy of consideration due to equipping the motor with an automatic or self-starter. In the operation of a mine electrically equipped, it will frequently happen that the power will fail for a time and then suddenly be renewed. As we say, the power will "go off the line" and after a short time "come on again." When that occurs a booster fan or a mine pump driven by the current must stop and, if not equipped with a self-starting device, will remain idle until someone is sent to start it again.

In order to avoid this annoyance and possible trouble from the accumulation of gas or water, which requires the continued operation of the fan or pump to remove, it is important that these machines be able to start automatically whenever power is turned on the line. Practically, the only conceivable disadvantage that might result from equipping a booster fan with a self-starter is the possibility that a body of gas might have accumulated, at some point, while the fan was idle, and be swept from its lodgment onto the open lights of workmen when the circulation is restored.

In a well regulated mine, booster fans are seldom required, and when installed, as this correspondent has stated, they should be kept running continuously. All things considered, there would seem to be greater advantage in the automatic equipment of fans and pumps when operated underground than where constant attention is necessary to keep them running.

WHEN POWER FAILS, SELF-STARTING DEVICE THROWS IN A RESISTANCE

An automatic or self-starting device is an arrangement such that when the power goes off, or fails, a resistance is automatically cut in, which enables the motor to pick up its load gradually when the power again comes on the line. Without that resistance being present in the circuit, the motor would be unable to start, and remain dead. The armature of a motor has but a small resistance and, there being no counter electromotive force generated when the machine is not running, it is necessary to introduce a starting resistance that will prevent the large rush of current that would otherwise flow. As the speed of the motor increases, this starting resistance is gradually cut out and the counter electromotive force generated takes its place.

Change in Magnetic Declination

Kindly publish, in *Coal Age*, a rule or explain the method of determining the proper needle bearing of a line when the description of the survey, as taken from the county records, gives the magnetic bearing and date when the survey was made. In attempting to return such a survey from the old notes, we failed to find the corner, because we did not know how much the direction of the needle had changed since the survey was made. The date of this survey is 1881, and the notes give the bearing of the line, at that time, as N. 32° 28′ E. What I want to know is the present needle bearing of this line and the rule for calculating the same.

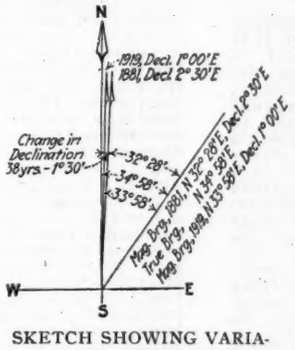
Orme, Tenn. GEORGE CAIN, Supt.,
Battle Creek Coal & Coke Co.

Owing to the fact that the north magnetic pole does not correspond to the geographic pole, and is not even known to have a fixed relative position thereto, the direction of the magnetic needle, whose north end points more or less constantly to the magnetic pole, only corresponds to a meridian line passing through the geographic pole when the magnetic pole lies in that meridian, except at certain long periods or intervals of time.

ECCENTRICITY OF THE MAGNETIC POLE CAUSES A VARIATION IN THE DECLINATION OF THE NEEDLE

As a result of this eccentricity of the magnetic pole, there is a constant change taking place in the declination of the needle, by which is meant the angle that the needle makes with the true meridian passing through the place of observation. Thus, the magnetic meridian as indicated by the needle is continually oscillating from east to west and from west to east. For a time, the angle of declination will increase to the east, attain a maximum and then decrease to zero, after which it increases to the west and, attaining a similar maximum, again decreases to zero. These variations in the direction of the magnetic needle take place very slowly, the change from zero declination to a maximum and back again to zero requiring a hundred years or more.

A little study of the situation will make it clear that, for any given time, the declination of the needle will be different in different places. It will appear also that, on a certain line extending from the magnetic north to the magnetic south pole and passing through the geographic poles of the earth, the needle will have a zero declination, ignoring possible local attractions, which would naturally affect its direction. In other words, the magnetic north will correspond to the geographic north at all places on this line of no declination, which is called an "agonic line."

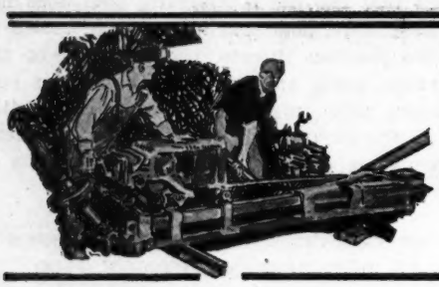

N
1919, Decl. 1° 00′ E
1881, Decl. 2° 30′ E
Change in Declination 38 yrs - 1° 30′
32° 28′
34° 58′
33° 58′
Mag. Brg., 1881, N 32° 28′ E, Decl. 2° 30′ E
True Brg., N 34° 58′ E
Mag. Brg., 1919, N 33° 58′ E, Decl. 1° 00′ E
W
E
S

SKETCH SHOWING VARIATION OF THE NEEDLE

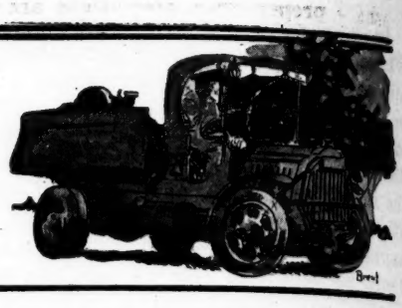
It is quite clear that all places lying east of the agonic line will have a west declination and all places on the west of the line an east declination. Also, from what has been explained, it will be evident that the agonic line oscillates from east to west and from west to east through long periods of time. Speaking generally, at the present time, the agonic line appears to be moving slowly to the west, causing a gradual increase in west declinations and a corresponding decrease in east declinations.

The best published information on this subject is an extended article in the Encyclopedia Britannica, eleventh edition, on "Terrestrial Magnetism," by Charles Chree, Superintendent Kew Observatory. Also, the report (1906) of the United States Coast and Geodetic Survey gives the change in declination, as observed at Chattanooga, Tenn. From the data there given, it appears that the declination in southeastern Tennessee, 1881, was practically 2° 30′E and that this easterly declination has decreased, to the present time, 1° 30′, which would make the present declination in that locality 1 deg. east.

Therefore, replying to the question asked and basing the answer on this information, it would appear that a magnetic bearing of N 32° 28′E, decl. 2° 30′E would correspond to a true bearing of N34° 58′E. Then, taking the present declination as 1° 00′ E, the magnetic bearing of the line now would be N33° 58′E, all of which we have illustrated in the accompanying figure.



COAL AND COKE NEWS



Charleston, W. Va.

Strikes at tide cause embargo on eastern shipments from smokeless and high volatile fields. Vessels plentiful but dumping facilities inadequate. Car supply 70 per cent. for week ended Oct. 18. Production in New River and Kanawha fields equal to car supply. Output goes west.

With everybody concentrating on tidewater shipments, terminals in the East have been literally inundated with coal from this section, and when to such a condition was added first the longshoremen's strike and then the tug boat strike, coal piled up at tidewater to such an extent during the week ended Oct. 18, that eastern coal shipments were embargoed entirely insofar as shipments from the high volatile and the smokeless fields of this section were concerned. There had previously been an embargo which was lifted for a few days, only to be imposed again. Vessels were plentiful but dumping facilities for the reasons just stated were inadequate and consequently export shipments of coal were retarded.

While up to Oct. 18 the car supply had been materially in excess of that for the same period of September, it was not over 70 per cent. for the weekly working period just alluded to, and consequently there was still a general production loss of 70 per cent. in all fields in this section. Congestion in the East has had the effect of increasing Western shipments just at a time when the prospects of a strike have increased the Western demand; although up until the eighteenth there had been no special flurry in the West.

West Virginia operators were sanguine that there would be no strike of bituminous miners, although every effort was being made to get out as much coal as possible before Nov. 1, in the event that there should be a strike. There has been no such sharp increase in price as has been charged by John L. Lewis, producers in West Virginia, on the other hand, discouraging insofar as possible any price advance. Of course, with the car supply so limited it has not been possible to produce much coal over and above that called for under contracts entered into earlier in the year.

While there was a steady demand for steam coal in evidence in this section during the week ended the eighteenth, there was no influx of inquiries growing out of the prospects of a strike until the beginning of the following week, when many consumers seemed to be seeking cover.

The large flow of smokeless coal to tidewater from the New River field was materially checked during the week ended Oct. 18, when another embargo was clamped down on eastbound coal shipments, and once again the tide of smokeless was turned to the West where it was readily absorbed as it had been during a part of the previous week. The embargo, of course, had no influence on production since there has been a demand for smokeless coal which it has long been impossible to meet.

While export markets now afford the main avenues of outlet for the product of New River, nevertheless there is a general demand for that kind of coal in other markets; the fact that the car supply is still averaging only about 70 per cent. preventing producers from mining much more than enough fuel to take care of contract requirements. While the supply of cars at the outset of the week ended the eighteenth reached almost 90 per cent. it soon dropped to 70 per cent. At the beginning of the following week assurances were given that empties returned from the Lakes would make for a good supply. More or less labor unrest was apparent in the New River field where operators were hopeful that miners would not be affected by the general strike call, although it is believed that the miners will strike in that field if a general strike call is issued.

There was no apparent abatement in the demand for steam coal as well as for other grades of coal in the Kanawha district during the weekly working period ended Oct. 18. Just about the time mines in this field had begun to resume shipments on the usual scale to the seaboard, another embargo erected a temporary barrier, and the Lakes and inland West markets began to receive large consignments.

As there was a fair demand in that part of the country, it did not discourage production in the Kanawha field which averaged about 70 per cent of capacity throughout the week; the output was confined to that figure owing to the limited supply of cars available, large at the beginning of the week but perceptibly smaller before its close. It was not until the week beginning the twentieth that there was any material flurry apparent in the demand for coal; consumers, as the danger of a strike became more apparent, seeking to provide for an additional supply of coal.

Charleston—The number of fatal accidents in the state of West Virginia reached a total of 31 in September, according to figures just completed by the West Virginia Department of Mines; nearly all of such accidents being due to falling coal, rock and slate, the number of fatalities from such a cause being 18. Motors, however, killed four mine workers and mine cars, two. Two men were fatally hurt by mining machines, one man being electrocuted and one being fatally injured through a cause not given. There were only three deaths on the exterior of the mines, two of them resulting from mine car accidents. Of the 31 mine workers killed, 23 were Americans and the remaining eight foreigners. McDowell County led with the largest number of deaths—10. The next largest number of deaths was in Logan and Wyoming counties, where there were three each. There were two fatal accidents in each of the counties of Fayette and Harrison and one death in each of the following counties: Barbour, Boone, Braxton, Clay, Marion, Mercer, Mingo, Ohio, Raleigh, Tucker and Upshur.

Fairmont, W. Va.

Prospects of strike causes sudden demand for Fairmont coal with consequent increase in price. Railroads begging for fuel. Production for week ended Oct. 18, not so large as for previous week. Cars not so plentiful.

By Oct. 18 the gravity of a strike seemed to have impressed itself on buyers to the extent that much anxiety was manifested in providing for future needs, and, consequently, there was a greatly accentuated demand for coal in the Fairmont and other northern West Virginia regions. Buyers holding contracts sought to secure tonnages in excess of that specified in contracts, but were unable to do so in large part owing to the widespread demand and the inability of Fairmont and other operators to meet such demand. Of course the sudden increase in demand raised prices to a higher level, the increase being fully 50c a ton over the rate ruling the latter part of September.

Another development of the week was an S. O. S. call from the Baltimore & Ohio and a few other railroads for more coal. The B. & O. has run short in its supply and needs, it is said, in the neighborhood of 200,000 tons. It is understood that that road has only a small reserve stock and is almost begging for coal. Some satisfaction is derived by producers from the fact that the B. & O., in order to secure any fuel, is obliged to pay the current price for coal—from $2.50 to $2.65 a ton. Earlier in the year when coal was plentiful, the B. & O., (in common with other roads) was trying to lower the price of coal; so now little sympathy exists among operators, and the road is finding it difficult to secure an adequate supply, even though expressing a willingness to accept coal loaded in box cars.

While production was not so large as it had been during the previous week, owing to the fact that cars were not quite so plentiful, nevertheless production was fairly well maintained, though toward the end of the week the car supply became somewhat short and placements were rather tardy. However, Curtis Bay shipments were almost 100 per cent. larger than during the previous week when all records in coal loading were broken. There was a fairly large tonnage of coal moving to the Lakes and to inland West markets. Certain points on the Monongahela R. R., were embargoed so that tidewater shipments of coal were shut off from Port Reading and one or two other ports.

Huntington, W. Va.

Logan mines producing 67 per cent. of normal. Car supply somewhat improved. Threatened strike stimulates demand and raises prices. Embargo on shipments to tide. Output goes West. C. & O. handles 645,350 tons for week ended Oct. 18.

There was an upward trend to production in the Guyan field during the week ended Oct. 18 owing to a somewhat improved car supply, the output advancing from 65 to about 67 per cent. or from 219,000 to 223,000 tons. This, as just stated, became possible owing to the fact that the time lost from car shortage was reduced by about 200 hours or from 100,000 to 87,0000 tons, so that the loss from transportation disabilities now amounts to only about 26 per cent. There was a two per cent. loss only from labor shortage. The total production loss was 109,000 tons as against 118,000 for the previous week. Despite the fact that Logan mines are producing only 67 per cent of their possible output, the output is in the neighborhood of 50,000 in excess of that for the same period of 1918.

In common with other districts in West Virginia, the producers of the Logan field observed a sharp difference in demand beginning on Oct. 20, when a threatened strike in all bituminous fields had the effect of stimulating the demand to quite a marked extent; this was true of all coals produced in the Logan fields. With the increase in demand there also came a rise in prices the pace being set by the prospective customers rather than by the producers. However, it was impossible to

accommodate buyers desiring a surplus supply owing to the inability of operators to much more than fill contract needs. Gas and splint were cut off from tidewater during nearly all of the week ended the eighteenth, through an embargo giving Logan producers an opportunity to take care of western trade where there was a stiffening demand in evidence.

While the loading of coal in some districts reached by the Chesapeake & Ohio was heavier than during the previous week, yet a less amount of coal was handled by the C. & O. system during the week ended Oct. 18 than was the case during the week ended the eleventh; only 12,907 cars, or a total of 645,350 tons, being handled by the road during the period ended the eighteenth.

Victoria, B. C.

The collieries of Vancouver Island are working steadily, there being no signs at the moment of anything but the best of feeling between the employed and the employer. Generally speaking the miners are working on the understanding that, with further increases in the cost of living, their wages advance. This applies to most with the exception of the Canadian Western Fuel Co., and the relationship between the latter and its men, as a result of the recent adjustment of the wage question, is of the best. The product, for the most part, is being used to care for the domestic demand which now is heavy because of the approach of the winter. From North Vancouver and other districts comes the report that difficulty is being experienced in obtaining sufficient to take care of current orders. For this reason there is a belief that a shortage of coal may be experienced before the spring. This, however, is speculation. Responsible opinion appears to be that the collieries can be depended upon to take care of the local situation and, in any event, there is no serious shortage as yet.

At the annual meeting of the Mine Rescue and Ambulance Association of the Canadian Western Fuel Co., which was held recently at Nanaimo, J. Thompson was elected president; E. V. Paterson, secretary-treasurer, with J. W. Jensen as assistant; and to the Executive Committee, in addition to the chairmen of the various committees, were appointed W. H. Moore, George Yarrow and George Moore. A feature of the proceedings was the presentation of $100 to the winners of competitions held at the Labor Day Meet in Nanaimo under the auspices of the Mine Safety Association of Vancouver Island. Mr. Moore explained that these prizes were not in the nature of payment but were provided by the Company in recognition of the hard work to which the men had been subjected in preparation. The recipients were members of teams captained by J. W. Jensen, George Carson, J. Barton, J. Brown, A. McNeill, R. Channock, J. McCourt, and M. Gunniss. It was decided that a paper on first aid work would be delivered monthly before the members of the Association. This is only one of the arrangements made to sustain interest during the ensuing few months and to promote the object of the Association, namely, the equipping of every miner for practical help in case of need.

The Coalmont Coal Mining Co is producing about 150 tons a day. The coal is shipped to the Kettle Valley Ry., by truck. Negotiations are in progress for the construction of a railway spur to the property which has turned out well under development.

The recent litigation with reference to the title to coal rights within the foreshore lands of the Eastern Coast of Vancouver Island, which now is declared to lie with the Province, and the report that steps may be expected towards the opening up of the coal deposits of Suquash and vicinity on an extensive scale, have made the reports of Dr. Charles H. Clapp and Dr. B. D. Dowling, the two principal geologists to investigate this area, of special interest. Dr. Clapp in his report on the industry in Memoir 51 of the Geological Survey Series, says:

"The future of the coal industry is very promising, although thinner and deeper coals will have to be mined in the near future. As already state, two new shaft mines have reached the Douglas seam in area of 181 square miles."

In his estimate of coal resources Dr. Clapp places the production at 24,500,000 tons up to 1912 and it recently estimated that the figure now would stand at about 30,000,000 tons. Dr. Dowling places the probable resources of the Nanaimo field at 1,340,000,000 tons.

The coal occurs chiefly in the lower part of the Nanaimo series in three seams, the Wellington, the Newcastle and the Douglas. The lowest seam, the Wellington, lies at the base of the Extension formation and rests on the East Wellington sandstone, and is about 700 feet above the base of the Nanaimo series. The Newcastle seam occurs at the base of the Newcastle formation, and overlies the Wellington seam by about 800 to 1,000 feet. The Douglas seam is contained in the Newcastle formation and from 25 to 100 feet above the Newcastle seam.

The coals of the various seams are as a whole much alike, and are high volatile bituminous coals of fair quality. The amount of fixed carbon in the best quality ranges from 45 to 60 per cent. and the ash from 5 to 10 per cent. The coal, especially that from the Wellington seam, cokes readily.

Some interesting evidence was given recently at Edmonton, Alberta, before the Coal Commission appointed to investigate conditions with reference to the available supply of this fuel, cost of production, etc. C. G. Sheldon, of the Humberstone Coal Co.; W. S. Cupples, of the Great West Coal Co.; H. C. Anderson, of the Twin City Coal Co.; L. E. Drummond, of the Mountain Park Coal Co.; and W. C. MacKay, of the MacKay Coal Co., were among those heard. All the operators were agreed that there was a great over-development of the mines in the district; the fact that they only work five or six months in the year was a big factor in the cost, for the upkeep during the remainder of the year had to be borne by the coal produced during the short producing period of the year.

Pennsylvania

Bituminous

Washington—A contract for sinking a new coal shaft in Tylerdale, a part of this place, has been awarded by the Washington Gas Coal Co., to the R. G. Johnson Co., of Pittsburgh, Pa. Work is expected to be pushed and the shaft to be completed in six months. The shaft will be 260 feet deep and be timber-lined. The Washington company owns a block of several hundred acres of coal in Canton Township, which will be developed by means of this new shaft. The Johnson company recently completed three new shafts between Washington and Wheeling. Early in the spring the company turned over a concrete-lined shaft to the Lincoln Gas Coal Co.

Pittsburgh—The Republic Iron and Steel Co. is remodeling its Russelton No. 1 coal mine at Rusesiton, Pa., in what is known as the Freeport district. This company is replacing the wooden shaft lining with concrete and a frame tipple with steel. Steam driven power units are to be supplanted by machinery utilizing power purchased from the West Penn Power Co. The improvements are expected to bring the plant up to a high state of efficiency.

Anthracite

Scranton—Three tracts of coal lands in Fell Township have been sold by the Salem Mountain Coal Co. (of which Mr. and Mrs. J. R. Dainty are principle stockholders), to David M. Rosser, acting for the Cranston Coal Co., of Kingston. The consideration was $5,000.

Hazelton—Campion & Co., of Mahanoy City, which recently acquired the culm banks at the abandoned operations of the old Silver Brook colliery, is erecting a washery and expects to have the plant going by January.

Shamokin—One man was instantly killed, another probably fatally injured and two others badly cut and bruised at the Pennsylvania colliery of the Susquehanna Collieries Co., near this place. A tremendous fall of coal in old workings, created a rush of air of great force, which swept through a gangway, hurling Irving Bitterman, a driver, against timber and causing instant death. A loaded mine car was also set in motion and ran over John Fracol, a laborer, causing very serious injuries. Two miners, Charles Pruski and Steven Delamel, were thrown from a chute and badly cut and bruised. It is said that the fall of coal was the most extensive that has occurred in this section in recent years.

Pottsville—The ancient grievance of anthracite miners — "docking" — was heard by the Conciliation Board at this place. Those making complaint were the following: Miners of the Corbin colliery, near Shamokin, employed by the Excelsior Coal Co.; Contract miners at the Primrose colliery of the Lehigh Valley Coal Co. Employees of the Buck Ridge Coal Co., asked that the company be ordered to pay them 40 per cent. increase in wages under the war scale, instead of $2 a day as at present. The Board also gave time to the consideration of the rates being paid by the Susquehanna Collieries Co., for pillar work at Williamstown. Grievances of employees at the Cameron colliery at Shamokin, also were considered.

Tamaqua—It is reported that the Hudson Coal Co., is drilling its propery at a site about a half mile east of Middleport, near here. A half century ago some of the seams in this section were mined to a very limited extent above the water level. Now the proposition is to prove the coal at depth preparatory to opening up a modern plant on the property. It is stated that the Hudson Company controls a considerable acreage in this section.

Industrial News

Sydney Mines, N. S.—The miners of the Jubilee colliery, here, are to be given steady work in future, and the bottom seam is to continue in operation. This statement is reported to have been made by T. J. Brown, general superintendent at the Nova Scotia Steel and Coal Co. This company recently completed arrangements with the Canadian railroads to supply them with coal. This is a shaft mine, longwall mining machines will be installed at once and active mining operations will commence, insuring steady work. It was stated that the lower seam would not be developed for large production for some time. At present mining in this seam is more or less of an experiment, but if conditions prove favorable it will be developed to greater capacity.

Dover, Del.—The Pocohontas & Sewanee Coal and Coke Co., has been incorporated with a capital of $2,500,000. R. A. Norton, Batavia, Ohio; J. T. Simmons and G. W. McMellow, of Cincinnati, are the incorporators.

Charleston, W. Va.—For developing coal land in the Big Sandy district, the Barren Creek Colliery Co. has been incorporated here with $2,000,000 capital. J. B. Hart, Fred O. Blue, R. E. McCabe, Edward Hart and John Hart, al of Charleston, are the incorporators. They have engineers now engaged in preparing plans for opening mines, installing machinery building houses and providing the other necessaries for a large coal output.

Morgantown, W. Va.—It is generally accepted as a fact that all the coal holdings, mines and assets of the Elkins Coal and Coke Co. in northern West Virginia, are about to be purchased by the Bethlehem Steel Corporation for the sum of $4,000,000. Negotiations were well under way, it is said, when the steel strike was declared, interfering with negotiations to some extent but the understanding now is that the sale is about to be consum-

mated. While most of the mines of the Elkins company are in Preston County, W. Va., yet the company also has three mines in Monongalia County. Should the Bethlehem company take over the Elkins properties, it would presage further development in Preston County. It is probable that Reedsville, W. Va., would be established as the headquarters of the coal and coke department of the steel company in the event of a sale. The Elkins Coal and Coke Co. is one of the few remaining large coal holdings of the estate of the late Stephen B. Elkins. It is believed that the acquisition provides the Bethlehem corporation with coal reserves estimated at 150,000,000 tons, meeting full requirements for coking, heating and steam coal.

Charleston, W. Va.—The Lima Coal Co. had expected to begin operations at its new plant in Clay County, W. Va., by the middle of October, but delay in the delivery of material has prevented completion of the plant, and it will be Dec. 1 before the company is able to begin mining and shipping coal.

Huntington, W. Va.—Louisville business men are behind the movement to further develop coal lands in Floyd County, Ky., having organized under the laws of West Virginia, the Huntington Cannel Coal Co. with a capital of $350,000. Chiefly interested in the new concern are: W. W. Smith, of Huntington; Judith D. Fried, Prestonburg; William J. Bray, E. H. Callahan, and L. K. Smith, all of Louisville, Ky.

Huntington, W. Va.—It is understood here that Delaware, New York and Philadelphia capitalists have in view the purchase of a large portion of the coal properties of E. B. Carr, of Philadelphia. Mr. Carr owns nearly 80,000 acres of coal and oil lands in Morgan County, Kentucky. The understanding is that the prospective purchasers propose to organize and charter a $10,000,000 corporation in Delaware, to purchase and develop at least a part of the Carr properties located in the center of the Kentucky coal and oil region, heretofore untouched insofar as the Carr lands are concerned. Should such development be undertaken, as seems highly probable, it will be necessary for the Chesapeake & Ohio to build an extension into the Morgan County field.

Wheeling, W. Va.—With the expectation of operating in Marshall County, near Moundsville (the county seat), the Miami Coal and Coke Co. has been formed with a capital of $60,000. The plans of this company indicate further expansion of mining operations in Marshall County which has been most marked during the summer months. Identified with the new company are: C. E. Brown, O. P. Wilson, W. A. McGlumphy, Chas. E. Showacre, John E. Hamilton, all of Moundsville.

Beckley, W. W.—The Beckley Coal Mining Co. expects to be in a position to begin operations before long with its new plant on Meadow Creek which is now nearing completion. All work preparatory to actual operations is well under way, including the grading for a side track and for an incline.

Pittsburgh, Pa.—The Cement Gun Co. has recently opened offices at 211 Fulton Building at this places. H. K. Heathfield has been named as district manager of the branch office which will include the Traylor, Dewey Contracting Co. (cement gun specialists) and the Traylor Engineering and Manufacturing Co.—manufacturers of mining, milling, smelting and crushing machinery.

Chicago, Ill.—The engineering firm of Jacobson & Schraeder, Inc., with offices in the Marquette Building here, has recently taken over the entire top floor of the Majestic Building, Chicago, and has also established a branch office in the Oliver Building, Pittsburgh, Pa.

Akron, Ohio—Recently a unique banquet was held at this place under the auspices of the B. F. Goodrich Rubber Co. At this novel function no one was given admittance who had not been in the company 20 years or more. The affair was attended by 160 men and women employees. Officials and workmen alike were among the veterans, in fact a comfortable majority of them were superintendents, department heads, managers and sales and finance executives. During the evening each one of the 160 employees was awarded a gold service pin. The history of the growth of the company from its beginning in 1870 was told on this occasion and illustrated by slides. Today the Goodrich factories comprise 63 buildings and employ 20,000 workers.

Wilmington, Del.—The Atlas Powder Co., of this place, announces the removal of its general offices to 140 North Broad St., Philadelphia, Pa.

Charleston, W. Va.—The Boone County Coal Corporation, W. M. Wiley, of New York, vice president and general manager, will issue additional stock to the amount of $3,000,000 to provide for further development of its various properties. It owns 32,650 acres of bituminous coal land, on which are mining developments with an annual output of about 2,000,000 tons of coal.

Spokane, Wash.—Spokane capitalists have purchased and taken hold of the development of the coal properties, at Detillion bridge, on the former Spokane Indian reservation, near Miles, Wash. This property belonged to B. F. Tilsley and associates, and the new owners are preparing to put on a large force of men to drive a tunnel to intersect the coal seams at the lowest possible surface depth. The 85-foot shaft that has been sunk shows coal of excellent quality, the coal outcroppings getting better with depth.

Buffalo, N. Y.—The mine of the J. B. Jenkins Coal Co., at Mabie, W. Va., has been sold to the Randolph Coal Co., of Elkins, W. Va. It has an output of about 100,000 tons annually and employs 100 men. The principal owner was F. P. Merrill, of Hornell, N. Y.; the management was in the hands of General Sales Agent Charles A. Storck, with an office in this city, where it has been since the organization of the company.

Charleston, W. Va.—The Pilgrim Land and Coal Co., of Chattaroy, W. Va., was incorporated to operate mines in Kentucky; capital stock $50,000; incorporators, H. V. Ingham, R. H. Campbell, W. E. Morgan, M. A. Emmons, of Chattaroy; A. D. Runyon, of Delorme, W. Va.

Brownsville, Pa.—Samuel N. Sapper and wife, of German Township, Fayette County, Pa., Thomas S. Collier and wife, of Uniontown and Allen and Samuel N. Sapper, (executors of Leonard Sapper), conveyed to the Ontario Gas Coal Co., 13 tracts of the Pittsburgh, or River seam of coal, for a consideration of $350,000.

Princeton, W. Va.—The building of a branch line by the Virginian Ry. from Maben on its main line into the Milam Fork district of Wyoming County, W. Va., will make possible the development of a considerable avreage of Pocahontas coal. Some 30,000 acres in the Milam Fork area, are owned by the Wyoming Pacahontas Land Co., (headed by Andrew Squires) in which Cleveland capitalists are largely interested.

Zanesville, Ohio—The Ohio Standard Coal Co., of this place, has been incorporated with a capital of $50,000. The incorporators are Artrur W. Sieglaff, H. A. Taylor, Gus G. Katesempes, H. A. Sharpe, B. S. Goldman and P. H. Tannerhill.

Clements, Md.—The Morgantown Salkelt Company of this place is making extensive preparations for the development of a large tract of coal. The concern is composed of Pittsburgh interests and Roy Salkelt is one of the chief owners.

Martins Ferry, Ohio—Former Congressman W. B. Francis, of this place, is at the head of a $200,000 coal company, which has purchased the holdings of the Yukon & Pittsburgh Coal Co., in Meigs County, of this state.

Charleston, W. Va.—The Castle Pallo Coal Co., of Clarksburg, W. Va., was incorporated to operate mines in Taylor County of this state with a capital stock of $50,000. The incorporators are: John A. Washington, H. B. Cooper, C. H. Harris, N. L. Shiplett and P. W. Bailey, all of Clarksburg.

Charleston, W. Va.—The Donnelly Coal Co., of Garden, was incorporated with a capital stock of $25,000. The incorporators are: F. J. Ravenscroft, Robert Donnelly, J. V. Healey, James Donnelly and John M. Donnelly, all of Elk Garden, W. Va.

Indianapolis, Ind.—The Mencheli Coal Co., of Clinton, was incorporated with a capital of $40,000 for the purpose of coal mining. The directors are: William F. Brown, Sr., James B. Brown and William Brown, Jr.

Whitesburg, Ky.—S. B. Hardy, C. C. Bryon and others who have organized the Darby Fork Coal Co., at Catlettsburg, Ky., with $100,000 capital, have announced the opening of new mines on Beaver Creek.

Charleston, W. Va.—The Marine and Commerce Pocahontas Corporation, of Welch, W. Va., was incorporated to operate mines in McDowell; capital stock $500,000; incorporators, W. Arthur Howell, Percy Bullock, Wm. G. Lare, Crittenden H. Adams, and Sanford D. Stockton, Jr., all of New York City.

Louisville, Ky.—The Pilgrim Coal Co., of Chattaroy, W. Va., was incorporated to operate mines in Kentucky; capital stock, $50,000; incorporators, H. V. Ingham, R. H. Campbell, W. E. Morgan, M. A. Emmons, of Chattaroy; and A. D. Runyon, of Delorme, W. Va.

Charleston, W. Va.—The plant and property of the Baren Creek Coal Co., at Barren Creek, on the Coal & Coke R. R., near Clay W. Va., has been transferred to the Barren Creek Colliery Co. The latter company has just been organized by John B. Hart of Charleston, head of the Bartland Colliery Co. Two separate tracts of coal were acquired, one of 100 acres and another of 307 acres, both in Big Sandy district, on Elk River.

Trade Catalogs

Abatement of Corrosion in Central Heating System. By F. N. Speller, Department of the Interior. Bureau of Mines. Technical Paper 236. Illustrated; pp. 12; 5⅞x9⅛ inches.

Universal Concentrating Tables—Overstrom Manufacturing Co., San Francisco, Cal. Bulletin U1. pp. 11; 9x11½ in.; illustrated. Contains facts about the table from the maker and users.

Standardized Material-Hauling Machines—Barber-Green Co., Aurora, Ill. Catalogue No. 3. Pp. 32; 8½x11 in.; illustrated. Description of **B.-G.** standardized belt conveyors, portable and stationary conveyors and self feeding bucket loaders.

Scranton Pumping Machinery—The Scranton Pump Co., Scranton, Pa. Bulletins Nos. 101 to 109 inclusive, and No. 113. All bulletins (except No. 104) illustrated; 6x9 inches. Bulletin No. 101: Duplex Piston Pumps; pp. 16. No. 102: Duplex Plunger Pumps; pp. 12. No. 103: Jet Condensers and Vacuum Pumps; pp. 12. No. 104: Triplex Power Pumps; pp. 4. No. 105: Triplex Plunger Pumps; pp. 8. No. 106: Triplex Plunger Pumps; pp. 8. No. 107: Triplex Plunger Pumps; pp. 12. No. 108: Triplex Plunger Pumps; pp. 8. No. 9 Triplex Plunger Pumps; pp. 8. No. 113: Standard Double Suction Volute Pumps; pp. 8. Each bulletin describes a different type of pump.

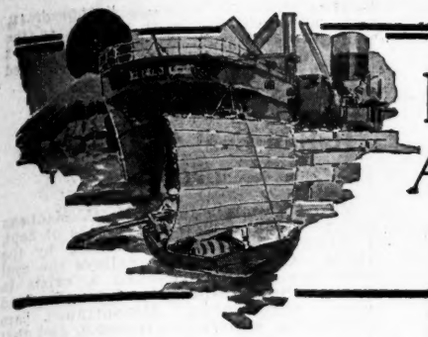
C. H. Rectangular Magnets—Cutler-Hammer Manufacturing Co., Milwaukee Wis. Booklet J, pp. 8; 8½x11 in.; illustrated. Describes magnets which are particularly adapted for efficient handling of regular shapes in steel and iron. Illustrations show their use at various plants.

Coming Meetings

American Society of Mechanical Engineers will hold its annual meeting Dec. 2-5 in New York. Secretary, Calvin W. Rice, 29 West 39th St., New York City.

Canadian Mining Institute will meet Nov. 26-28, in Vancouver, B. C., Canada. Dr. E. T. Hodge, professor of geology at the University of British Columbia, has been appointed general secretary of this meeting.

Coal Mining Institute of America will hold its 33rd annual meeting Dec. 3 and 4 at Pittsburgh, Penn. Secretary, H. D. Mason, Jr., Mine Safety Appliances Co., Pittsburgh, Penn.



FOREIGN MARKETS AND EXPORT NEWS

EDITED BY ALEX MOSS

Market Conditions for Coal in the Port of Naples

(Consul B. Harvey Carroll, Naples, Italy)

Naples, situated on the great Mediterranean-Asiatic steamship route which is now gradually assuming its former importance as an international trading route, is becoming again an important coaling station.

Southern Italy is generally supplied with coal by Great Britain through the port of Naples. The main kinds of coal on the market are Welsh, North Country, Pocahontas and New River. Inquiries are constantly being made regarding the supply that America can offer.

During the war the importation of coal into Italy through the port of Naples has been under the control of the Government. This regulation still obtains and the Royal Commissioner of the port, through whom permission is secured for the importation, is Vice Admiral Cutinelli. Statistics for imports are not available.

Facilities for Discharging Coal

There are three main centers in the Bay of Naples for the discharge of supplies of coal—Torre Annunziata and Portici, the regular port of Naples, and the Punto Franco or the free zone. Torre Annunziata and Portici together are the least important of the three centers, there being no facilities at those places comparable to those in the port of Naples proper. Coal there is unloaded on lighters and entirely discharged by hand. The regular port and the free zone have facilities for unloading and handling coal. There is dock space, plenty of labor, and to a certain extent machinery adequate for handling large supplies of goods. The depth of the water in the inclosed part of the port varies between 8 and 30 meters, and the water at all of the docks is deep enough to permit the entrance of the largest ocean-going steamships.

Labor at the port is normally readily obtainable. Coal is unloaded by workmen carrying it in baskets on their shoulders. These workmen are paid in normal times from 2.50 lire to 3 lire per day. As much as 4500 tons have been unloaded in 27 hours in this way. Regular workmen at the port, the supervisors and foremen, are paid now from 20 to 30 lire per day.

The free zone in the port of Naples occupies a space of 18,500 square meters, of which 3840 are devoted to the outer wharf and 6380 to the buildings. Unloading of goods in this part of the port takes place by means of cranes worked by hydraulic machinery. The transportation of goods to various parts of the warehouses is by a chain of dockhands who pass the goods from man to man. The advantages of the free zone are that goods can be brought into it and moved freely without the surveillance of the customs officials until it is actually carried into the city or dispatched to another place by rail. In other parts of the port special arrangement has to be made through the office of the acpitaneria of the port or with the agent who arranges the permission for docking through his office. A ship entered in this manner becomes subject to the regular tariff fees of the port and subject to its regulations. Derricks mounted on railway cars are readily available for the moving of coal from the ships to railway cars.

In Naples unloading of coal is done by the workmen who carry it in baskets on their shoulders. There are seven cranes in the port which are controlled by the Naples Chamber of Commerce. Six of these have a capacity of 15 quintals each and one is capable of lifting 25 quintals. Altogether they have an aggregate capacity of 250 metric tons.

After authority for unloading has been secured from the comissioner of the port the ship is assigned to its place and takes its turn. The tariff of the port for coal is 0.17 lira per ton. The expense of weighing the coal is paid by the consignee at the rate of 0.22 lira per ton and 0.07 lira for the men who operate the scales.

Coal Situation in Denmark

The U. S. Shipping Board reecntly announced that Denmark had placed 16 steamships, aggregating 61,000 tons, in the coal trade for carrying coal from America to Denmark. According to information received by the Danish Legation, two additional Danish steamers have now been chartered to carry coal from Hampton Roads to Danish ports.

Denmark normally imports 3,400,000 tons of coal and coke yearly, mostly from England, but also some from Germany. During the war it was difficult for Denmark to obtain the necessary coal supplies, and the importation decreased to about 2,000,000 tons a year. It was generally expected that conditions in the coal trade would become normal again as soon as peace was declared, but on the contrary the situation became worse.

Hardly any coal was exported from Germany, and England, suffering from a decreased coal production and an increased demand, put heavy export taxes on her coal. Denmark has continuously had about 150,000 tons of ships carrying coal from Great Britain, but while the months of May, June and July showed a fairly satisfactory increase in the importation of coal, August imports dropped considerably, and in the first week of September only 37,000 tons were received, or much less than it takes to keep Denmark going, even with the greatest economy.

Under the circumstances the Danish authorities are contemplating adopting once more the restrictive measures which were in force during the war, and during the coming winter coal will probably again be rationed for factories as well as for the homes.

The American import from which Denmark expected so much amounted to only 25,000 tons all told, in June, July and August. It is hoped, however, that the coal fleet which the Danish Government has now placed in the American trade will shortly relieve the serious coal shortage from which Denmark at present is suffering.

Coal Production in Poland

The chief coal-producing area of Poland, writes a consular official from Warsaw under date of Aug. 17, 1919, is known as the Dombrowa Basin, located to the west of the city of Krakow. The principal mining towns are Dombrowa, Sosnowiece, Katowice and Bedzyn. The report of the labor inspector of that district for the second quarter of 1919 indicates that industrial operations are being resumed in a fairly satisfactory manner. On June 30, 1919, 52 coal mines were running.

The following table shows the number of laborers and the production in the coal mines of Dombrowa for February, 1919:

Mines	Number of Laborers	Tons Extracted	Tons Shipped
Georges	1.071	17,721	11,020
Ladislas	815	12,033	7.649
Mortimer	1,303	14,774	6,033
Victor	2,035	28,910	23.142
Saturn	1,858	28,012	23,711
Jupiter	1,532	13,813	9,166
Cte. Renard ..	2,705	35,289	26,778
Andre 11	266	2,241	974
Ste. Varsovienne	4,130	39,765	31,940
Paris and Koszelew ..	2,660	24,709	22,379
Czeladz	2,026	30,904	24,714
Grodziec 11 ..	1,550	19,392	13,947
Flora	1,915	18,861	14,863
Radem	1,420	16,664	9,349
Antoni	644	4,684	4,084
Grodziec	400	3,235	1,777
Total	26,330	312,007	231,520
Surface mines	4,737	33,369	28,337
Grand total.	31,067	345,376	259,857

The number of days worked during the month was 24. Of the total number of 31,067 miners, 1,235 were employed in the smaller surface mines and 1,425 in lignite mines.

These Polish coal mines have been worked for over a century and, from 1790 to 1799, slightly over 8,000 tons were extracted from the Dombrowa Basin. The production in pre-war times is indicated by the following figures, which give the output in 1911: Dombrowa (Poland), 5,769,928 tons; Krakow (Galicia), 1,653,724 tons. The production of the Upper Silesian mines in the same year was 36,622,969 tons; and that of the Ostrawa-Karwin mines in Austrian Silesia, 8,073,713 tons. Thus the total output of Polish mines was 52,120,334 tons. The production of coal in France in the same year was about 40,000,000 tons.

In 1910 the mines of the Dombrowa Basin, worked by steam, represented a total force of 42,317 hp., and those worked by electric motors 21,944 hp. In the Krakow mines the mechanical force amounts to only 11,955 horsepower.

The average output per miner in the Dohmbrowa district was 233 tons in 1913, and in the Galician mines, 282 tons.

Acute Coal Shortage in Industrial Districts of Northern France

The coal shortage in the industrial centers of northern France is becoming acute, and manufacturers are registering complaint with French officials, acocrding to a dispatch received by the Bureau of Foreign and Domestic Commerce from the American Embassy at Paris. Doual, formerly one of the important centers of the coal-mining industry, whose mines are now flooded and for the most part not producing, has complained that coal cannot be obtained for its reviving industries and its attempt at speedy reconstruction.

Several of the power stations in the Paris district, according to the report, have notified manufacturers that because of insufficient production of electricity they cannot meet industrial demands.

There is not only an absolute shortage of coal, but the quality of the coal available is poor, and power stations report they are getting 25 per cent less production out of the high-priced coal now coming in than they got out of the coal ordinarily used.

In complaints made recently it was stated that if the situation gets any worse there is imminent danger of a general shutdown of all the industries in the Paris district. Labor organizations as well as manufacturers are calling on the Government to meet this grave situation.

Coal Resources of Spitzbergen

Exploration work has proved that the group of Arctic islands known as Spitzbergen possess a wealth of coal. Of the three geological formations in which the coal occurs, the tertiary formation holds the most valuable seams. These seams are uniform in quality and thickness throughout the whole tertiary formation. Coal mining is being carried on by Norwegian, Swedish, English and Russian companies. The largest workable deposits are in Norwegian hands, and these areas have the most favorable location as regards ice and harbor conditions.

The coal output is characteristic of the distribution of the various interests. In 1918 the following quantities were shipped from Spitzbergen: From Norwegian-owned mines (600 hands) 55,000 tons; from Swedish-owned mines (100 hands), 4,000 tons; from Russian-owned mines (40 hands), 2,500 tons. The English territory, stretching over large areas, holds only relatively small deposits of workable coal.

Norwegian Coal Companies in Spitzbergen.

The following are the names of the Norwegian coal companies in Spitzbergen:

Store Norske Spitzbergen Kul Kompani, which has its mines at Advent Bay and Green Harbor. This company has a share capital of 9,000,000 crowns (at normal exchange the Norwegian crown is worth $0.268), and has been formed through the purchase of several English, American and Norwegian properties. About 350 hands, all Norwegian, are employed. The output in 1918 was about 40,000 tons, all of which was shipped to Norway. The output for 1919 is expected to run to about 60,000 tons. The company owns the mining town of Longyear City, with 30 dwelling houses, warehouse, power station and wireless-telegraph installation. Now that the war is over the company expects to work the output of the mines at Advent Bay alone to 200,000 tons.

A/S De Norske Kulfelter Spitsbergen also has its field in Advent Bay. The property was bought from an English company, the Spitzbergen Coal and Trading Co. Preparatory work was commenced in 1916. Last summer the company employed about 100 hands.

A/S Svalbard, formed in 1916, has its fields in the Advent Valley and in Green Harbor. The company is not working, but has watchmen on the property.

Kings Bay Kul Comp. A/S, of Aalesund, has its field in Kings Bay. The company commenced operations in 1917, and shipped about 13,000 tons of coal in 1918. The output in 1919 is expected to reach 25,000 tons. It employs about 150 hands.

Spitsbergen Kul og Mineral A/S, at Bell Sound, has carried on trial operations, but has now only watchmen on the spot.

A/S Kulspids is for the present only carrying on trial work at Recherche Bay.

Bjornoen Aktieselskap, on Bear Island, has a share capital of 4,000,000 crowns and owns the whole of the territory on this island.

The Norwegian companies are about to make large extensions, and, when they have completed their plant for full production in the course of a few years, they will presumably be able to cover the requirements of northern Norway. In connection with these Norwegian undertakings, mention may be made of a large English company that has mines and is carrying on trial operations at Bell Sound. A Russian company is erecting a plant at Green Harbor and a Swedish company owns coal fields at Braganza Bay.—Norwegian Trade Review.

Belgian Coal Transmitted as Electrical Energy to Italy

An agreement between Italy and Belgium stipulates that Italy is to receive from Belgium 60,000 tans of coal a month, which, however, must be transported at the charge of the Italian Government and with the facilities it furnishes. Because of the present lack of railway cars and of Italian mercantile tonnage, the transportation of this coal is difficult—almost impossible.

The remedy for this evil state of affairs is mentioned today in the project of the engineer Emilio Guarini, which is now undergoing an examination by Hymans, the Belgian Minister, and Dante Ferraris, Italian Minister of Industry, Commerce and Labor. Guarini proposes burning the coal in the Belgian mining districts—thus being able to make use of low-grade coal and even of coal dust—then, by means of a transmission line 1,200 kilometers long, transporting the energy evolved from the combustion of the coal at a tension of 150,000 volts and a total power of from 500,000 to 1,200,000 kilowatts. Guarini computes the cost of a kilowatt-hour obtained in this way at 8 centesimi about 1½ cents); whereas if the energy were obtained from coal brought in by railway, the kilowatt-hour cost would be 18 centesimi (about 3½ cents.)

It is further to be noted that with central stations of 100,000-kilowatt capacity the consumption of coal for industry is reduced to two-thirds what it would otherwise be. This saving would repay Belgium in large part all the expenses that would have to be incurred in the instalaltion of central plants with capacities of 1,500,000 kilowatts, equivalent to 12,000,000 tons of mineral fuel annually.

As a precedent for his scheme, Guarini cites an English company which has set up a power plant in South Africa to carry 1,200 kilometers a current of 500,000 horsepower developed from the force of the Zambesi falling into Lake Victoria Nyanza.—L'Epoca, Sept. 10, 1919.

Coal Production in Great Britain

Returns of coal production in Great Britain recently made public by the (Government) Board of Trade show that the output fell from 4,812,595 tons for the week ending May 31, 1919, to 2,642,895 for the week ending Aug. 9; but later figures now available show that there has been a rise in production since that time. For the week ending Aug. 23 the output, according to the Board of Trade, was 3,989,762 tons. However, as compared with the figures for May 31 there is still a shortage of 822,833 tons.

The most striking fiures are for the Yorkshire district, where during the period under review, the weekly output fluctuated between the maximum of 788,770 tons and a minimum of 5,540 tons—this latter for the week ending Aug. 2. For the week ending Aug. 9 there was an increase to 10,734 tons, and for the following week an advance to 19,917 tons; and in the week ending Aug. 23 output in the Yorkshire district rose to 162,638 tons.

The 7-hour working day was put into operation on July 16. During the week ended July 12, the production figures for Great Britain were 4,796,148 tons. In the following week, after the 7-hour law had been in operation for about three days, the output was 3,893,652 tons. During the next week (ended July 26), the output declined to 2,537,954 tons. Since that time there has been a steady increase, with the exception of the week ended Aug. 9, during which time the bank holiday intervened. As there are about 1,100,000 men and boys employed in the mining industry above and below ground, the figures shaw an average output of 4½ tons a week for each person in the month ended July 12 and less than 3 tons a week in the month ended Aug. 9.

Italian Coal Situation Improves

Trade Commissioner H. C. MacLean reports from Rome under date of Sept. 1, that the measures adopted by the Italian Government to relieve the coal shortage, which reached a crisis in July, when shipments from England were temporarily discontinued, are producing satisfacory results, and that the outlook for the future is considerably brighter. Imports of coal in August amounted to 600,000 tons, of which 350,000 tons came from England and 150,000 tons from the United States. This shows a considerable increase in the imports of American coal, which in June amounted to only about 65,000 tons and in July to about 100,000 tons. Furthermore, through the Italian Commision in the United States contracts had bee made for about 600,000 tons of coal c. i. f. Italian ports, and about 300,0000 tons more f. o. b. American ports. These contracts cover a period of about eight months.

During September Italy hopes to receive 400,000 to 450,000 tons of coal from England, and Belgium has agreed to furnish 50,000 tons per month. Some shipments have been coming through from Poland, although conditions there are too uncertain to permit a continuous supply. Furthermore, shipments of German coal from Westphalia begin Sept. 1, although it is impossible to say definitely at this time how much will be received from this source. Owing to transportation conditions France is unable to utilize all the German coal which is available and Italy is taking advantage of this condition.

Commissioner Laviosa, head of the Coal Office of the Italian Government, considers freight rates on coal from the the United States to Italy too high to favor the introduction of American coal on a large scale. He called attention to the fact that since the recent increase in the demand for American coal. rates had been increased, whereas England is maintaining its freight rates at the lowest posible figure in order to retain the business.

The unfavorable exchange is, of course, another serious obstacle to purchase in the United States. American coal is now quoted at Genoa at 320 lire ($61.76) per ton against 295 lire ($56.93) per ton for Cardiff coal.

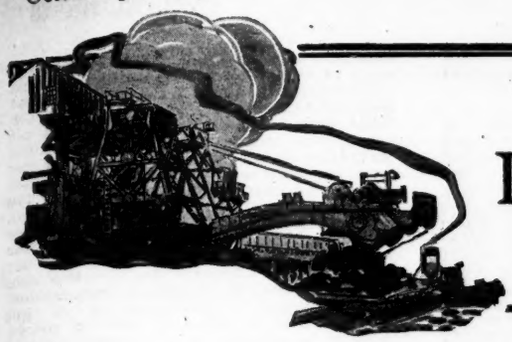
Bunker and Cargo Coal in Nova Scotia

There are three companies in the Sydney consular district which furnish bunker and cargo coal from the local mines. The Dominion Coal Co. (Ltd.) supplies both bunker and cargo coal at Sydney and Louisburg; the Nova Scotia Steel and Coal Co. (Ltd.) performs the same services at North Sydney; and the Inverness Railway and Coal Co. at Port Hastings on the Straits of Canso.

The amount of coal on hand and available at the three first ports mentioned for bunker is practically unlimited: for cargo the output of the local mines is something about 300,000 long tons per month. It is believed that over 50,000 tons might be contracted for to be used as cargo. The minimum stock which might be relied upon at all times for cargo would be much less.

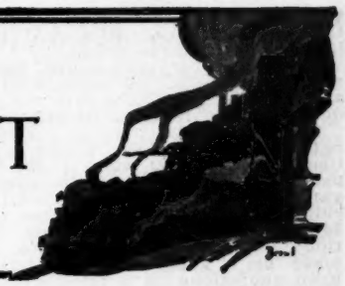
Over 50,000 tons of coal per month are supplied for bunkering from June 1 to Nov. 1. No figures are available for cargo coal.

The present price of cargo coal is $5.65. Bunker coal is furnished at $7 per ton and 25 cents for trimming. In 1916 the price averaged about $5 per ton of 2250 lbs. and was much less before the European war. The effect of the war has been to double the cost of coal and other supplies and decrease the production of coal in this district 25 per cent.



MARKET DEPARTMENT

EDITED BY ALEX MOSS



Weekly Review

Coal Strike will be of Short Duration—Union Workers Obey Strike Order—Nonunion Fields Working to Capacity—Prices Fixed by Government.

Signs are not wanting at this writing of the speedy ending of the bituminous coal strike. Conditions as they now exist are intolerable to producers, miners and consumers alike, and it is quite likely that the operators and the mine workers leaders will come together in the near future and settle their differences.

In union mines, virtually all the workers responded to the strike order. In the nonunion fields the men stuck to their jobs, and though it is too early to estimate the tonnage that will be produced by the loyal workers, the situation is generally satisfactory.

In Pennsylvania, the National Coal Association reports, about 70,000 out of 180,000 men went out. In West Virginia, production is about one-half of normal. Illinois, Indiana and Ohio have been hard hit by the strike. According to reports, not a mine in any of these states is working. Kentucky is working to about 50 per cent. of normal, while in the Georges Creek field in Maryland only one mine was reported to be operating on Monday of this week.

The Southern fields are quiet, though Alabama reports that a large number of mines are running. Reports from the West show that Utah mines are working at nearly normal. Operations in Colorado have been curtailed about 70 per cent.

To circumvent any possibility of profiteering on the part of unscrupulous operators and dealers, the Government on Oct. 30, re-established the maximum prices of bituminous coal that prevailed prior to Feb. 1, 1919. In addition it has again assumed control of distribution, coal being confiscated in transit and held on sidetracks and in railroad yards subject to Governmental allotment.

No complaints of hardship as a direct result of the strike have come to hand. Some sections of the country are well stocked with fuel, the New England States in particular. The embargo placed on coastwise and foreign coal shipments will work out to the benefit of so-called esssential industries in this country whose reserve stocks are dwindling.

Every one fervently hopes that the situation here will not duplicate that of the miners' strike in Yorkshire, England, last summer. That strike cost Great Britain $53,000,000. In wages alone the English miners lost $16,500,000, and a strike fund of over $1,362,620, which it took the men 25 years to accumulate, was exhausted in one month.

WEEKLY COAL PRODUCTION

Recovering from the slight decline of the week before, the production of bituminous coal rose to a new high record for the year during the week ended Oct. 11. The curve of average daily output has left the line of 1917 far behind and now threatens to overtake the course of the 1918 line. The week's production is estimated at 11,924,000 tons, an increase of 3.4 per cent. over the preceding week, and greater by 311,000 tons than that of the first week in October, which had hitherto been the highest this year. The record could not have been accomplished had not all the agencies affecting production lent hearty assistance. Labor disturbances were at a minimum. Consumers, influenced in part by reports of a threatened strike in the bituminous fields, were quick to take the coal offered. The railroads supplied the mines sufficient equipment to load 217,749 cars of soft coal, 38,064 cars of anthracite and 306,000 tons of beehive coke. The record was the more remarkable in that it was attained during a period when fears had been expressed that the steel strike would react unfavorably upon the production of coal.

The anthracite region shared in the activity reported by the bituminous industry during the week of Oct. 11. Production is estimated at 1,955,000 net tons, an increase of 34,000 tons, or 1.8 per cent., over the preceding week. The current rate of production has been exceeded but once this year, and like that of bituminous coal, now closely approaches the performance of the corresponding season of 1918.

The output of beehive coke continued to decline slightly during the week ended Oct. 11. The total production of the country is estimated at 306,038 net tons, a decrease of 2.1 per cent. compared with the preceding week. The effect of the steel strike upon the demand for coke is suggested by the following statement, in which the current weekly output is compared with the average of the four weeks immediately preceding the strike: During first week of strike production was 78 per cent. of pre-strike average; during second week of strike production was 71 per cent. of pre-strike average; during third week of strike production was 69 per cent. of pre-strike average. The strike has not yet carried the production of beehive coke to as low a level as prevailed witnout interruption from the middle of last April to early July.

Lake shipments, as indicated by dumpings of bituminous coal at lower lake ports, were marked by a sharp increase during the week ended Oct. 4. The tonnage dumped was 725,986, nearly 25 per cent. greater than that of the preceding week. Shipments were no doubt stimulated by anxiety of consumers at the head of the lakes to make sure of supplies in anticipation of the threatened coal strike and by a tendency of producers to apply on their lake contracts capacity released by the slackening demand from the steel industry.

NEW YORK.

Anthracite steam coal situation shows improvement. Demand increases and quotations are stronger. The call for egg, stove and chestnut continues strong. New England lacks coal and buying is heavy. Consumers of bituminous aroused by strike talk and demand increases, as well as quotations. Big producers make efforts to keep prices down.

Anthracite—Considerable improvement is noticeable in the steam coal situation. Demand has picked up and there has been a corresponding betterment in the quotations. The improvement is attributed generally to the threatened strike in the soft coal mines and the lack of bituminous coal at the local docks which has been apparent the past few weeks. Shippers of anthracite steam coals see an opportunity to regain some of the trade lost several years back to the bituminous operators.

The demand for the domestic coals continues strong, particularly in New England. Locally there is a good call, caused in most part by the continuation of the strike in the harbor and the resultant slow deliveries.

There is a steady call for chestnut, egg and stove in the order named, the trade inland taking more of the first named size than is taken locally. None of the sizes is plentiful but the larger companies are able to keep their customers supplied. Independent producers find a ready market, notably throughout New England where dealers are said to be offering premiums.

Pea coal moves easily although the city dealers have an accumulation in their yards because of the heavy tonnages taken in the early summer when there was a scarcity of the larger sizes and it was necessary to accept the smaller size in order to get the larger.

Inquiries for the steam coals are increasing and shippers of the better grades find no difficulty in unloading their tonnages. There were reports

that premiums were being offered for the better grades. Rice coal is the longest of the three sizes.

Dumpings for anthracite for the week ended Oct. 24 were 5,507 cars as compared with 5,220 cars the previous week, an increase of 287 cars.

Bituminous—The fear of a strike on Saturday of this week began to show itself in the local market the latter part of the week when consumers began to place orders for additional shipments. At about the same time a few shippers increased their quotations, although efforts were being made by a great many producers to keep quotations on a level with what they had been for the past several weeks.

The strengthening of prices was not general among shippers but was attributed to a small minority and it was generally predicted that a great majority of the producers would refuse to advance their prices even though a strike would be inaugurated.

There is no accumulation of coal here. Some shippers have no coal at the local docks. Contract coals move rapidly and large consumers are watching the free coal situation. Railroads are reported as picking up any surplus tonnages they are able to find and there was some talk of their being about ready to confiscate tonnages in anticipation of the strike.

The efforts of consumers to get in a supply of coal before Nov. 1 is reflected in the report of the Railroad Administration which shows that 6,267 cars of bituminous were dumped at the local docks during the seven days ended Oct. 24, as compared with 4,790 cars the previous week, an increase of 1,477 cars.

Producers and shippers are carefully watching the outcome of the Federal officials efforts in Washington to bring peace in the miners ranks and predict that should the miners strike it will mean a considerable loss to the bituminous interests in that it will open the field for a heavier consumption of the anthracite steam sizes and also the consumption of oil which has already secured a strong foot-hold here as well as throughout New England and other sections of the country.

Boats are generally loaded although there may be no immediate buyer in prospect. The shipping interests have been hard hit by the continuation of the local marine labor difficulties and many vessels are forced to go to other loading ports for their supply of bunker coals.

Inquiries for export business continue to increase and buyers are not confining themselves to the coals contained in Pools 1, 9 and 71, but are willing in some instances, to consider coals sent to Pool No. 10.

Quotations for the various pools fluctuate continually, no quotation holding good for more than 24 hrs., as a rule. Late in the week the various pools were being quoted about as follows:

Nos. 1, 9 and 71, $6.50 to $6.75; No. 10, $6.25 to $6.50; No. 11, $6 to $6.25, and Nos. 18 and 41, $5.85 to $6.

Quotations on spot coal at the mines, were likewies continually changing but the following shows a fair range:

	Spot.
So. Forks (best)	$4.00—$4.25
Cambria (best)	3.50— 3.75
Cambria (ordinary)	3.10— 3.35
Clearfield (best)	3.50— 3.75
Clearfield (ordinary)	3.10— 3.35
Reynoldsville	3.25— 3.45
Quemahoning	3.75— 4.00
Somerset (medium)	3.25— 3.50
Somerset (poor)	3.00— 3.25
West Maryland	2.75— 3.00
Fairmont	2.50— 2.75
Fairmont ¾	3.10— 3.25
Latrobe	2.80— 3.00
Greensburg	2.90— 3.10
Westmoreland ¾	3.75— 4.00
Westmoreland r-m	3.50— 3.75

Philadelphia

Anthracite trade stirred by strike talk. Heavy calls for stove and nut. Egg still in heavy demand. Shipments light. Car shortage appears for first time. Pea is in fair demand, but receipts are about equal to outgo. Steam coals quiet. Bituminous market much upset by imminence of strike. Good demand for all coal. Wholesalers hold prices down. Few spot quotations.

Anthracite—From the standpoint of activity the retail business during the past week left nothing to be desired except the most vital need—coal. The people refusing to note any difference in the strike situation as between the anthracite and bituminous coal busines, take it for granted almost generally that there is trouble in store for them after Nov. 1. This was quickly shown in the amount of new business offered to retailers and in addition there were hundreds of anxious inquiries as to when orders already placed would be delivered. The weather has been in no way conducive to active buying and the demand for fuel is simply due to the trouble brewing in the soft coal fields.

As it is, the real demand for fuel continues to be confined to stove and nut, with these sizes running a close race for pupularity. Coal dealers consulted find it difficult to explain why so many people heretofore accustomed to use a smaller size are now insisting on either of the two sizes above mentioned. The only explanation seems to be that while pea coal is a greater economy, yet it requires more attention in burning, and as the public seems to have the price it is indulging in the luxury of the larger sizes. Price appears to be a secondary object. The demand for egg has in no wise falien off and it would seem that the call for this size, which is out of all proportion to that of a few years ago, can be traced to the increasing adoption of the pipeless furnace in this part of the country.

The shipments into the city have only been fair recently and for the first time this season shippers are inclined to blame car shortage in a measure. Early in the week the railroads withdrew a great deal of equipment from the anthracite trade in the effort to expedite shipments from the bituminous region, and this has reacted on the receipts of domestic coal. In any event this is only temporary. for no matter what takes place in the soft coal region car distribution is likely to be placed on its former basis in the anthracite region. In the event of a soft coal strike it is felt by some that it will throw quite a number of additional workers into the anthracite field and thus speed up production. On the other hand with a strike in the soft coal region there is no telling in times like these what might happen in the hard coal region, even though the men have agreed to work under the old agreement until next April.

The only shipments up to normal are those on pea coal orders. It can be said that the demand for this size slowly increases and this week perhaps did a little better than usual, as there is always a certain proportion of the consumers who are willing to take the next best thing to be had. The dealers are continuing to advertise the advantage of using this size, showing that there is a difference in cost of over $2 a ton. Despite the increasing sales it is not believed that many dealers have succeeded in reducing stocks, as the companies if they ship anything seems to be sure to ship pea. With the continuance of mild weather more than one dealer is expressing doubts of his ability to move it all before spring.

The steam coal situation is really unchanged. The real big users have been stocking up all summer and now there are only normal receipts being taken by most shippers. Buckwheat is moving fairly well, but even up to a week ago it was possible to buy this size off price; lately with possible trouble with bituminous coal there has been a tendency to stiffen the price, but certainly to date it has not increased shipments. Rice is being called for in fair volume, with much going into storage yards and a still greater tonnage of barley.

Bituminous—The imminence of the threatened strike has much upset the trade. There has been quite a heavy demand for coal of the high grades, with the result that there has been little for the spot market at all. Many consumers, however, display complete indifference to the situation, especially those concerns with a three or four months' supply ahead. From the beginning of the week prices began to mount fairly rapidly, until Friday, when most houses temporarily declined to quote. This was ascribed to the fact that the operators seeing the seriousness of a rapidly rising market, got together in a meeting and decided that all sales should be made on a basis of just the regular commission for brokerage coal, with the understanding that prices would be kept as low as possible. Quite a few houses are not quoting yet, but are simply offering to procure coal at the lowest price plus a commission. Under such conditions it is not practicable to give a list of prices, but in a general way it can be said the best coals are running between $3.40 and $4.

Pittsburgh

Opinions on strike vary. Miners' demands impossible.

At this writing the chances seem to be tbout evenly divided as to whether or not there will be a general coal strike Nov. 1. Some observers think there will be a strike, some think there wil not, and some insist they have formed no opinion. Operators are united on one thing, that the miners' demands are absolutely impossible to grant. Even if the operators were willin, the burden passed on to the public would be more than it could bear.

As to the Pittsburgh district, it is pointed out that the day-labor cost of coal per ton is almost as great as the cost of mining itself, and as day labor demands 60 per cent. advance, with the company to pay for time spent going to and from the working face, the day-labor cost per ton would be increased much more than 60 per cent., while if overtime for hours beyond six were paid the increase would be augmented in that way, while capital charges per ton would be increased.

Coal operators state that on regular business there has been no material increase in prices in the past week, though it is admitted that odd lot sales have been made at fancy figures. There has been an effort on the part of many consumers to stock up. It is regarded now as too late to make purchases for this purpose, because if the strike becomes a certainty the railroads will doubtless commandeer coal in transit and the shipments would not reach the buyer.

Retail dealers have been buying domestic coal, and the great bulk of the sales in the past week of such coal have been at $2.75 for ¾-in. and $2.90 and $3 for 1¼-in. The regular market is regarded as standing about as follows: Slack, $2.20 and $2.30; steam mine-run, $2.30 and $2.40; gas mine-run, $2.50 and $2.70; prepared gas, $2.90 and $3.10; per net ton at mine, Pittsburgh district. Some odd lot business has been done, largely by brokers, as follows: Slack, $2.75 and $2.85; steam mine-run, $2.85 and $3.25; gas mine-run, $3.25 and $3.50; prepared gas, $3.50 and $4, per net ton at mine, Pittsburgh district.

Connellsville

Market up 50c in week. More blast furnaces operating. Threatened coal strike helps stiffen coke market.

There has been a further advance in coke in the past week, furnace coke in the past week, furnace coke selling up to $4.75, a 50c advance in the week, and foundry bringing about the same advance. The threatened coal strike has been an important influence, but apart from that there has been the better demand from furnaces, chiefly for stocking purposes, whereby all surplus coke has been moved, so that operators are indisposed to sell except at a fair price relative to cost of production, and $4.75 for furnace coke is regarded as such a price, representing the market value of the coal plus the bare cost of coking.

Blast furnace operations have continued to gain on the strike, though at a slow rate. The Shenango Valley is running almost full, and Buffalo is practically all running except the four

Rogers furnaces. Lackawanna Steel Co. sold its coal for only a short time and is now taking it all, together with coke due on contract. In the Mahoning Valley and in Cleveland a few blast furnaces have resumed, but the strike is still strong in both those quarters, while the Wheeling district remains tightly closed.

On occasional lots fancy prices have been obtained for foundry coke, and extremely high prices have been mentioned for first quarter contracts, apparently without consumers taking hold in any instance. The market for spot and prompt is as folows. Furnace, $4.75; foundry, $6 and $6.50, per net ton at ovens.

The "Courier" reports production in the Connellsville and Lower Connellsville region in the week ended Oct. 18 at 204,445 tons, an increase of 51,681 tons.

Buffalo

Some spasmodic advances in bituminous. Fear of strike is the cause. Most consumers have plenty of it. Anthracite going to the Upper Lakes fast.

Bituminous—The trade is in a sort of transition state, for two reasons. As a rule the consumers are well stocked up and good for a long shutdown, but there are always a few wno have failed to buy what they need for such an emergency and they are hunting for quick shipments. At the same time the mines are slow, so that if any deliveries are made promptly there must be special stimulus from some source. So the price in some instances has improved within the last day or two.

If the coal in shippers' hands could be distributed evenly according to consumption needs it would last several months. Some shipers say it would be good for six months or even longer, though this is a decidelly long time. It appears, then, that the strike will not need to be broken early if it does tie up the mines, which it is not expected to do even at the first. The general idea is that the miners will call the bluff, but with little expectation of winning. Even total failure will not count so squarely against them as to weaken now and call the strike off before it begins.

The jobbers are doing a pretty small business. The get few orders and it is not easy to fill what they get. So all they try to do is to keep in touch with the situation and be ready to resume when the difficulties are over, The effort to hear from such centers as Pittsburgh and Cleveland every day is common, though at present the letters and despatches are not conclusive as to anything. A strike of some sort is now generally looked for, but that it succeeds any better than the steelworkers' strike has done is not unlikely In some cases the prediction is made that the Government will interfere and put an end to the strike soon after it is declared.

The bituminous prices are unsteady and there will be small uniformity right away, so the following quotation must be taken as a fair average, with some coal selling at an advance of 50 cents or more a ton: $4.45 for Allegheny Valley sizes, $4.90 for Pittsburgh and No. 8 lump, $4.65 for same three-quarter, $4.20 for mine run, $4.10 for all slack, $4.60 for smokeless, $5.40 for Pennsylvania smithing, all per net ton, f. o. b. Buffalo.

Anthracite—The movement continues unusually active to the Lakes, but is correspondingly quiet in all other branches of the trade. Consumers are somewhat stirred up by the issuing of notices by the Public Service Commission ordering all natural gas burning apparatus that is capable of burning coal to be rigged for that fuel by the middle of December. The notice states that that arrangement kept the gas pressure up all winter for all strictly gas-burning stoves, though the fact was that the winter was so mild that there was small need of the regulation.

Some of the bituminous jobbers are actively engaged in selling independent anthracite, for which they ask all the way up to $3 premium, but as a rule so little of this coal can be had that small effort is made to obtain a supply. The regular quotations remain as follows:

	F. O. B. Cars, Gross Ton,	At Curb, Net Ton.
Grate	$8.55	$10.20
Egg	8.80	10.65
Stove	9.00	10.85
Chestnut	9.10	10.95
Pea	7.20	9.30
Buckwheat	5.70	7.75

The shipments to the Lakes have seldom been more active than they are now. Bituminous activity has not been well maintained all the season, but there will be considerably more anthracite moved by water than there was last season. Shipments for the week are 159,600 net tons. Rates are advancing slowly.

Coke: Buffalo, N. Y.—The demand for coke is slack. Consumption has been so much reduced by the strike that it will be some time before the regular output of material is reached again, though the strikers are returning to work pretty generally now. Prices are therefore a little better than nominal at $8 for 72-hr. Connellsville foundry, $7.50 for 48-hr. furnace, $7 for stock, $7.75 for domestic sizes and $5 for breeze. Iron ore is coming in by Lake at a good rate, all the cargoes tied up by the strike having been unloaded.

Cleveland

Feverish haste to stock coal against the threatened strike Nov. 1 features the various markets here. Though in instances prives have been advanced, the great majority of the dealers and operators are maintaining the old level.

Bituminous—Nothing has counted in the Cleveland market in the past week but the threatened strike. Demand for any and all kinds of coal has increased ten-fold, it appears. With the iron and steel plants in this district still unable to operate at more than 10 per cent of normal, much more coal—relatively—is available. Even so, it is doubtful if the average stock pile in Cleveland will last more than two weeks. Coal has been comparatively scarce in Cleveland all summer, and only in the past four weeks have any attempts been made to stock.

Opinion on the threatened strike is pretty well divided. One camp believes the mine workers are headed for sure defeat, and that public opinion is so adverse, that the strike is doomed to failure within ten days after the men walk out. On the other hand, some hold the belief that labor has been driven into a corner and that the President's now-defunct industrial conference has had the effect of solidifying labor and giving it a new lease of life.

Beneath both these undercurrents of opinion is the well-nigh unanimous sentiment that the government is not going to let the coal mines remain idle. Probably this wish is father to the thought, yet there is scarcely an operator who believes the government dare let the mine workers "get away" with such a flagrant breach of contract. Many look to see the war-time fuel restrictions under the Lever act revived.

One effect of the strike threat has been to deter iron and steel works from any concerted efforts to reopen. Believing that even if they did resume operations their fuel supply would be cut off shortly, most plants have been content to stay closed. The industrial paralysis is thus two-fold.

To the great credit of most of the operators here it must be said that they are making a conscientious attempt not to profiteer in the present emergency and give the mine workers basis for complaint. Prices undoubtedly are firmer, as they naturally would be, but except in instances that are the exception and not the rule, operators and dealers have not boosted prices. Domestic prices lately have shown a greater tendency to advance than have steam-coal prices.

Pocahontas—Though dealers are reassuring customers Pocahontas and anthracite miners do not contemplate striking Nov. 1, demand for these grades has increased with that for domestic bituminous. Prices have not been increased this week, but within another week advances will be in order, dealers warn. Supply is about 35 per cent of requirements at present.

Lake Trade—Lake Erie docks are dumping from 1,800 to 2,100 cars a day, or about 750,000 tons a week, against 1,300,000 to 1,400,000 tons a week in normal times. The carriers are available, but the cargoes are net. Production at the mines is low, but in the last few weeks a larger percentage of the mines' output has been diverted to local consumers. Of the 17,681,223 tons dumped for the Lake trade in the season to Oct. 1, 13,994,057 tons were to American ports and 3,687,166 tons to the Canadian side. American Lake Superior ports took 7,761,286 tons and Canadian ports on that lake 1,283,495 tons. Lake Michigan ports took 5,419,006 tons to Oct. 1. An effectual strike will completely tie up the Lake trade, it is agreed on all sides.

Prices of coal per net ton in Cleveland are:

Antracite—Egg, $11.75 to $11.90; chestnut, $12.00 to $12.20; grate, $11.75 to $11.90; stove, $11.90 to $12.10.

Pocahontas—Forked, $10.00 to $10.50; lump, $9.00 to $9.50, Mine-run, $7.90 to $8.00.

Domestic bituminous——West Virginia splint, $8.50; No. 8 Pittsburgh, $6.60 to $6.90; Massillon lump, $8.25 to $8.50; Cannel lump, $10.50; Coshocton lump, $7.15.

Steam coal—No. 6 slack, $5.25 to $5.50; No. 8 slack, $5.10 to $5.50; Youghiogheny slack, $5.25 to $5.50; No. 8 ¾-in., $5.70 to $6.00; No. 6 mine-run, $5.25 to $5.50; No. 8 mine-run, $5.75.

Columbus

A slight runaway market has developed in the past week, due to concern over the threatened suspension. Buyers of both domestic and steam sizes have flocked into the market, with the result that prices have advanced. Production is not large.

A strong market in every department of the industry in Ohio territory has developed as the time for the expected suspension approaches. Buyers of steam grades, which have shown little concern or fear previously, developed a desire to stock up in a hurry and flocked into the market. The result was that free coal was bid up to a higher point than has prevailed since the runaway market when the industry was taken over by the fuel administration. Steam users of every description placed orders for immediate shipment, and all available stocks were eagerly bought up. The result of the flurry was to advance prices for Hocking lump to $3.50 and $4 at the mines, and in some cases even higher. Hocking mine-run was quoted from $2.75 to $3, while screenings, which have been the weak point in the trade, advanced to $2.25 and $3. Reserve stocks are not large and strong effort is being made to cover at this late date.

The domestic trade also exhibited remarkable strength with prices advancing. Pocahontas is quite scarce, and the same is true of West Virginia splints. Retail stocks are only fair, and in some instances are lighter than usual for the time of the year. Dealers are selling rapidly to householders and all available teams and trucks are busy.

The Lake trade is rather active, as is noted by loadings at the Lower Lake ports during the week ending Oct. 25. The H. V. docks at Toledo loaded 114,875 tons as compared with 90,080 tons the previous week. The T. & O. C. docks also showed an increase in the movement. Lake shippers are trying to cover on their contracts before the suspension and are getting a large tonnage to the Northwest.

Production has been rather good under the circumstances. Some improvement in the car supply in the Hocking Valley field is reported and as a result the output is about 70 per cent. In eastern Ohio the car supply is reduced to about 60 per cent of requirements. Other fields are showing up with about 65 per cent production. The embargo against using open-top cars for the shipment of building supplies is expected to help the car situation. Prices delivered in Columbus are:

Hocking lump	$6.25
Hocking mine-run	5.50

Pomeroy lump	6.50
Pomeroy mine-run	5.65
Pocahontas lump	8.75
Pocahontas mine-run	7.50
Kentucky Wheeling Creek	7.50
West Virginia splints, lump	7.50

Cincinnati

The all-absorbing question the past week among the coal men of Cincinnati was the threatened strike of bituminous coal miners on Nov. 1. Inquiries during the week were mostly for coal for industrial purposes. The demand from industrial users was not great, owing to the fact that many of the plants have secured enough coal in the past few weeks to enable them to lay up a surplus. Ever since the talk of a miners' strike first appeared, the industrial consumers started to lay in their supply, with the result that today the greater portion have prepared to the best of their ability, availing themselves of every inch of storage capacity at their plants.

Coal men estimate that industrial plants, public utilities and domestic consumers in Cincinnati consume approximately 7,000 tons of coal daily during the winter months. It is also estimated that the city at the present time has a supply of about 250,000 tons. The coal men thus estimate that the strike will have to last longer than a month to cause suffering.

On account of the facilities offered by the Ohio River, there will be sufficient coal in barges along the river front in Cincinnati to take care of the needs here for that period. It is estimated that there are approximately 100,000 tons of coal already here or on barges en route to Cincinnati, enough to take care of the needs of industrial plants and domestic consumers for two weeks. It is estimated that about 70 per cent of the domestic users responded well to the warning last summer and stocked up for the winter.

Prices were well maintained during the past week. What coal is being received via the railroads is being fed out to consumers on contracts previously made and on which deliveries had to be delayed because of the delay in railroad transportation owing to the shortage of cars. Producers with headquarters here report that they are swamped with orders, the demand for West Virginia coal broadening to a great extent. The car supply, however, hold the mines to contract requirements. New River operators are being offered premiums for fuel. The Kentucky output is greatly curtailed because of car shortages. New River producers are being offered as high as $4.25 and $4.50 a ton for mine run smokeless, or about $1.50 in excess of contract prices, but comparatively few companies were able to take any additional business owing to export and domestic contracts which are taxing the capacity of New River mines in view of the inadequate car supply. Although shipments to eastern points have been resumed, there still is considerable smokeless being consigned to the west.

Operators attribute a drop in production of the northern Kentucky field of 15,000 tons as compared with the previous week entirely to car shortage, an increase of 8,000 tons in the car shortage loss being due to the failure of the L. & N. to furnish enough cars.

The steel strike has had little if any effect upon production, but has permitted a diversion of shipments to other industries in sore need of fuel. Little available tonnage remains uncontracted for and shippers are far behind on many of their orders because of a long-continued car shortage in previous months. The splendid supply of cars furnished by the C. & O. in previous weeks has dwindled slightly and the new allotment regulation has had serious effect on domestic mines in Kentucky, mainly because of the application of the double penalty for part loads left over, many mines being tempted to ship run of mine grades only.

Louisville

Threatened strike of miners demoralised market. Mines refusing quotations. Retailers and industrial consumers buying all the coal they can secure. Railroads confiscating coal according to report.

The market has gone wild during the week, and conditions have reached a stage where it is almost impossible to secure quotations. Many mines have contracted this season for about 40 per cent of their normal output, planning to sell the balance on the open market. However, with an uncertain car supply the volume available for open-market sales has been light. Numerous mines well sold up on open-market coal for next 30 days are refusing to quote any prices.

Retailers are short of coal, hardly a yard in the city having any block coal to speak of, and being short even on mine run, having delayed buying due to high prices and uncertainty concerning Federal control. Industrial consumers have become scared over the strike situation, and are stocking all the coal they can secure. It is reported that numerous industrial concerns have stocked three months' supply, and domestic consumers are fairly well stocked.

Reports in the coal trade on Tuesday, Oct. 21, were to the effect that the Illinois Central and Louisville & Nashville lines were commandeering coal shipments on their lines in order to lay up stock to carry them in event of a mine strike. These reports can not be verified, but dealers are worried over shipments that have not arrived.

Several large mine operators in eastern Kentucky are of the opinion that the strike will close a number of mines, and result in the balance being overloaded with business In some sections miners appear fairly well satisfied with conditions, but in other sections they are ready to walk out on short notice. Western Kentucky is also uncertain.

Louisville retailers during the week announced a 25 cent a ton advance on western Kentucky lump and a 50 cent advance on eastern Kentucky block, making west Kentucky $6.25 delivered, and east Kentucky $7.50 delivered.

Quotations are uncertain as some mines are getting top prices, while others are selling surplus over contracts at a maximum price which they are not going over. However, reports are being received of some eastern Kentucky mine run selling at $3.50 per ton net and some block at $5.25@5.50 Reports are also being received of some western Kentucky block being offered at $5 a ton, with the operators indifferent about making sales. Actual facts of the case are that coal is so scarce that there isn't a market.

Leading quotations are — Eastern Kentucky. Block, $4.25@$5.. Run of Mine, $3 @ $3.25; Nut and Slack, $2.60 @ $2.75.

Western Kentucky—Lump, $3.50@ $3.75; Mine Run, $2.40@$2.75; Nut and Slack, $2.25&$2.35; Pea and Slack, $1.60 @$1.70.

Detroit

Though not general, some improvement is reported in demand for bituminous steam coal in Detroit.

Bituminous—Even the strike called for Nov. 1 by the bituminous mine workers has failed to create an appearance of active buying in the Detroit market. Jobbers say that a number of the consumers of steam coal have not cast off the indifference that has marked their attitude toward the market, though some of the dilatory ones are now becoming purchasers.

Jobers say, however, there is a slight change for the better in the local buying demand, and that their customers outside Detroit are taking all the stock available. In this connection complaint is made of shortened mine production and a difficulty in obtaining a sufficient supply of cars for handling shipments.

Freight congestion is developing in the local market earlier than usual and the railroad administration has given warning that unless immediate improvement is effected in the matter of releasing cars held with freight of various descriptions, an order will be issued requiring any shipper having freight for Detroit to obtain a special permit before he will be able to obtain a car for loading. The transportation section of the Detroit Board of Commerce is striving to improve conditions.

Free coal on tracks is not plentiful in Detroit and jobbers say it is not a material factor in the trade. West Virginia lump is selling on a basis of $1.75 a net ton at the mines; egg size is offered at $4.50; mine run at $3.50, and slack at about $2.75. For Hocking domestic lump the price is around $4, for Hocking egg $3.50 to $3.70, for mine run $2.75 and for slack about $2.50.

Anthracite—Household demand for anthracite prepared sizes has been stimulated by the frosty weather and is not being satisfied as retailers have only small quantities of anthracite in stock. Their efforts to obtain additional supplies are not productive of satisfying results. Orders are not being filled promptly and shipments are slow in arriving.

Lake Trade—Shipments over the Lake routes are falling off. Lack of sufficient car supply is blamed for reducing shipments from some districts while reduced mine production is curtailing the movement from other points.

Chicago

The Chicago coal market is coming to resemble a mad scramble more than anything else. Dealers, factory owners and householders are clamoring for coal, and are using all means in their power to get distributors and operators to book orders for them. The householders, especially, are in a nervous state, and practically every yard in Chicago has been cleaned out of coal within the past three or four days. Luckily the weather has been mild, but it will only take a good cold spell to bring about a panic. There are some rumors that coal, and other necessities will be placed under Federal supervision, so that no profiteering will be possible. If things continue the way they have been for the past few days, this measure on the part of the Govednment will be wise.

Prices are not much different in Chicago than they are at other points in the Middle West. Larger companies, producing a better grade of coal, are holding prices down, while small companies, producing poor coal, are selling their outputs for higher prices, paradoxical as it may seem. Quality and preparation once more are forgotten, the main thing being just coal. Splint is selling in Chicago from $5 per ton f. o. b. mines up. Pocahontas prepared sizes are selling at even higher figures. Some poor-grade Illinois and Indiana lump is bringing as high as $4, while Franklin County, the peer of practically all Western coal, is still selling at $3.25.

St. Louis

A runaway market brought to a halt. A critical situation in the St. Louis territory if strike takes place. Railroads confiscating coal. Very little steam tonnage stored and practically no domestic. Country districts seriously affected.

The local situation is unsatisfactory on account of there being no steam coal stored and but little domestic. Possibly 30,000 to 40,000 tons of coal are stored in St. Louis by the dealers for both steam and domestic contracts. The railroads have not more than from a week to ten days' supply of coal ahead and the Wabash and Missouri Pacific are confiscating.

There is no Eastern coal coming in of any kind. There is a good supply of gashouse and by-product coke on hand, but no cars to load it in.

The Mt. Olive district is short of equipment, but is getting out a record-breaking tonnage. These operators in the St. Louis market are selling their coal at the regular circular, which is about $2.65 to the St. Louis trade and not over $3 to the country trade. It is the only field in Illinois where coal is being sold below what the trade is willing to pay for it.